# Operation

## Commercial/Recreational Mobile Generator Sets

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Models:

**10EORDB/EORZDB**
**15EORDB/EORZDB**
**20EORDB/EORZDB**
**30EORZDB**
**40EORZDB**
**9EFORDB/EFORZDB**
**12.5EFORDB/EFORZDB**
**16.5EFORDB/EFORZDB**
**25EFORZDB**
**33EFORZDB**

ISO 9001 KOHLER POWER SYSTEMS NATIONALLY REGISTERED

KOHLER® POWER SYSTEMS

TP-6551 4/08

**California Proposition 65**

## ⚠ WARNING

Engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

# Product Identification Information

Product identification numbers determine service parts. Record the product identification numbers in the spaces below immediately after unpacking the products so that the numbers are readily available for future reference. Record field-installed kit numbers after installing the kits.

### Generator Set Identification Numbers

Record the product identification numbers from the generator set nameplate(s).

Model Designation _____

Specification Number _____

Serial Number _____

| Accessory Number | Accessory Description |
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### Engine Identification

Record the product identification information from the engine nameplate.

Manufacturer _____

Model Designation _____

Serial Number _____

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IMPORTANT SAFETY INSTRUCTIONS. Electromechanical equipment, including generator sets, transfer switches, switchgear, and accessories, can cause bodily harm and pose life-threatening danger when improperly installed, operated, or maintained. To prevent accidents be aware of potential dangers and act safely. Read and follow all safety precautions and instructions. SAVE THESE INSTRUCTIONS.

This manual has several types of safety precautions and instructions: Danger, Warning, Caution, and Notice.

**DANGER**

Danger indicates the presence of a hazard that ***will cause severe personal injury, death***, or ***substantial property damage***.

**WARNING**

Warning indicates the presence of a hazard that ***can cause severe personal injury, death,*** or ***substantial property damage***.

**CAUTION**

Caution indicates the presence of a hazard that ***will*** or ***can cause minor personal injury*** or ***property damage***.

**NOTICE**

Notice communicates installation, operation, or maintenance information that is safety related but not hazard related.

Safety decals affixed to the equipment in prominent places alert the operator or service technician to potential hazards and explain how to act safely. The decals are shown throughout this publication to improve operator recognition. Replace missing or damaged decals.

## Accidental Starting

**WARNING**

**Accidental starting.**
**Can cause severe injury or death.**

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

**Disabling the generator set. Accidental starting can cause severe injury or death.** Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

## Engine Backfire/Flash Fire

**WARNING**

**Fire.**
**Can cause severe injury or death.**

Do not smoke or permit flames or sparks near fuels or the fuel system.

**Servicing the fuel system. A flash fire can cause severe injury or death.** Do not smoke or permit flames or sparks near the fuel injection system, fuel line, fuel filter, fuel pump, or other potential sources of spilled fuels or fuel vapors. Catch fuels in an approved container when removing the fuel line or fuel system.

**Servicing the air cleaner. A sudden backfire can cause severe injury or death.** Do not operate the generator set with the air cleaner removed.

**Combustible materials. A fire can cause severe injury or death.** Generator set engine fuels and fuel vapors are flammable and explosive. Handle these materials carefully to minimize the risk of fire or explosion. Equip the compartment or nearby area with a fully charged fire extinguisher. Select a fire extinguisher rated ABC or BC for electrical fires or as recommended by the local fire code or an authorized agency. Train all personnel on fire extinguisher operation and fire prevention procedures.

## Exhaust System

**WARNING**

**Carbon monoxide.**
**Can cause severe nausea, fainting, or death.**

The exhaust system must be leakproof and routinely inspected.

**Generator set operation. Carbon monoxide can cause severe nausea, fainting, or death.** Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Avoid breathing exhaust fumes when working on or near the generator set. Never operate the generator set inside a building unless the exhaust gas is piped safely outside. Never operate the generator set where exhaust gas could accumulate and seep back inside a potentially occupied building or vehicle. Do not obstruct the exhaust outlet when parking your vehicle. The exhaust gases must discharge freely to prevent carbon monoxide from deflecting into the vehicle.

**Carbon monoxide symptoms. Carbon monoxide can cause severe nausea, fainting, or death.** Carbon monoxide is a poisonous gas present in exhaust gases. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Carbon monoxide poisoning symptoms include but are not limited to the following:

- Light-headedness, dizziness
- Physical fatigue, weakness in joints and muscles
- Sleepiness, mental fatigue, inability to concentrate or speak clearly, blurred vision
- Stomachache, vomiting, nausea

If experiencing any of these symptoms and carbon monoxide poisoning is possible, seek fresh air immediately and remain active. Do not sit, lie down, or fall asleep. Alert others to the possibility of carbon monoxide poisoning. Seek medical attention if the condition of affected persons does not improve within minutes of breathing fresh air.

**Installing the exhaust tail pipe. Carbon monoxide can cause severe nausea, fainting, or death.** Install the exhaust system tail pipe to prevent the drawing of discharged exhaust gases into the vehicle interior through windows, doors, air conditioners, and other openings. Do not use flexible tail piping because it could crack and allow lethal exhaust fumes to enter the vehicle.

**Inspecting the exhaust system. Carbon monoxide can cause severe nausea, fainting, or death.** For the safety of the vehicle's occupants, install a carbon monoxide detector. Never operate the generator set without a functioning carbon monoxide detector. Inspect the detector before each generator set use.

## Fuel System

**⚠ WARNING**

**Explosive fuel vapors.**
**Can cause severe injury or death.**

Use extreme care when handling, storing, and using fuels.

**The fuel system. Explosive fuel vapors can cause severe injury or death.** Vaporized fuels are highly explosive. Use extreme care when handling and storing fuels. Store fuels in a well-ventilated area away from spark-producing equipment and out of the reach of children. Never add fuel to the tank while the engine is running because spilled fuel may ignite on contact with hot parts or from sparks. Do not smoke or permit flames or sparks to occur near sources of spilled fuel or fuel vapors. Keep the fuel lines and connections tight and in good condition. Do not replace flexible fuel lines with rigid lines. Use flexible sections to avoid fuel line breakage caused by vibration. Do not operate the generator set in the presence of fuel leaks, fuel accumulation, or sparks. Repair fuel systems before resuming generator set operation.

**Draining the fuel system. Explosive fuel vapors can cause severe injury or death.** Spilled fuel can cause an explosion. Use a container to catch fuel when draining the fuel system. Wipe up spilled fuel after draining the system.

## Hazardous Noise

**⚠ CAUTION**

**Hazardous noise.**
**Can cause hearing loss.**

Never operate the generator set without a muffler or with a faulty exhaust system.

**Engine noise. Hazardous noise can cause hearing loss.** Generator sets not equipped with sound enclosures can produce noise levels greater than 105 dBA. Prolonged exposure to noise levels greater than 85 dBA can cause permanent hearing loss. Wear hearing protection when near an operating generator set.

## Hazardous Voltage/ Moving Parts

**⚠ WARNING**

**Hazardous voltage. Moving parts.**
**Can cause severe injury or death.**

Operate the generator set only when all guards and electrical enclosures are in place.

**⚠ WARNING**

**Hazardous voltage.**
**Backfeed to the utility system can cause severe injury, death, or property damage.**

Connect the generator set to the building's electrical system only through an approved device and after the building's main switch is turned off.

**⚠ CAUTION**

**Welding the generator set.**
**Can cause severe electrical equipment damage.**

Never weld components of the generator set without first disconnecting the battery, controller wiring harness, and engine electronic control module (ECM).

**Servicing the generator set when it is operating. Exposed moving parts can cause severe injury or death.** Keep hands, feet, hair, clothing, and test leads away from the belts and pulleys when the generator set is running. Replace guards, screens, and covers before operating the generator set.

**Grounding electrical equipment. Hazardous voltage can cause severe injury or death.** Electrocution is possible whenever electricity is present. Ensure you comply with all applicable codes and standards. Electrically ground the generator set, transfer switch, and related equipment and electrical circuits. Turn off the main circuit breakers of all power sources before servicing the equipment. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

**Welding on the generator set. Can cause severe electrical equipment damage.** Before welding on the generator set perform the following steps: (1) Remove the battery cables, negative (–) lead first. (2) Disconnect all engine electronic control module (ECM) connectors. (3) Disconnect all generator set controller and voltage regulator circuit board connectors. (4) Disconnect the engine battery-charging alternator connections. (5) Attach the weld ground connection close to the weld location.

**Short circuits. Hazardous voltage/current can cause severe injury or death.** Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

**Engine block heater. Hazardous voltage can cause severe injury or death.** The engine block heater can cause electrical shock. Remove the engine block heater plug from the electrical outlet before working on the block heater electrical connections.

**Electrical backfeed to the utility. Hazardous backfeed voltage can cause severe injury or death.** Connect the generator set to the building/campground electrical system only through an approved device and after the building/campground main switch is turned off. Backfeed connections can cause severe injury or death to utility personnel working on power lines and/or personnel near the work area. Some states and localities prohibit unauthorized connection to the utility electrical system. Install a transfer switch to prevent interconnection of the generator set power and other sources of power.

## Hot Parts

**⚠ WARNING**

**Hot coolant and steam.**
**Can cause severe injury or death.**

Before removing the pressure cap, stop the generator set and allow it to cool. Then loosen the pressure cap to relieve pressure.

**Combustible materials. Fire can cause severe injury or death.** A hot exhaust system can ignite adjacent combustible materials. Do not locate electrical wiring, fuel lines, or combustible materials above the exhaust muffler. Exercise caution when parking your vehicle to prevent the exhaust system and hot exhaust gases from starting grass fires.

**Combustible materials. Fire can cause severe injury or death.** A hot generator set can ignite debris in the compartment. Keep the compartment and generator set clean and free of debris and combustible materials to minimize the possibility of fire. Do not block the fuel/oil drain opening in the generator set mounting tray. Cut a corresponding hole in the subfloor, if used, for the drain opening.

## Notice

**NOTICE**

**Canadian installations only**. For standby service connect the output of the generator set to a suitably rated transfer switch in accordance with Canadian Electrical Code, Part 1.

**NOTICE**

**This generator set does not comply with United States Coast Guard (USCG) requirements and must not be used for marine applications.** For marine installations use only generator sets specified for marine use. USCG Regulation 33CFR183 requires that a generator set must be ignition protected when used in a gasoline-fueled environment.

**NOTICE**

**Saltwater damage.** Saltwater quickly deteriorates metals. Wipe up saltwater on and around the generator set and remove salt deposits from metal surfaces.

# Notes

# Introduction

This manual provides operation instructions for 10–40EORDB/EORZDB and 9–33EFORDB/EFORZDB model generator sets.

Refer to the engine operation manual for generator set engine scheduled maintenance information.

Information in this publication represents data available at the time of print. Kohler Co. reserves the right to change this publication and the products represented without notice and without any obligation or liability whatsoever.

Read this manual and carefully follow all procedures and safety precautions to ensure proper equipment operation and to avoid bodily injury. Read and follow the Safety Precautions and Instructions section at the beginning of this manual. Keep this manual with the equipment for future reference.

The equipment service requirements are very important to safe and efficient operation. Inspect the parts often and perform required service at the prescribed intervals. Obtain service from an authorized service distributor/dealer to keep equipment in top condition.

**Before installing a mobile generator set, obtain the most current installation manual from your local distributor/dealer. Only qualified persons should install the generator set.**

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# Service Assistance

For professional advice on generator set power requirements and conscientious service, please contact your nearest Kohler distributor or dealer.

- Consult the Yellow Pages under the heading Generators—Electric.
- Visit the Kohler Power Systems website at KohlerPower.com.
- Look at the labels and stickers on your Kohler product or review the appropriate literature or documents included with the product.
- Call toll free in the US and Canada 1-800-544-2444.
- Outside the US and Canada, call the nearest regional office.

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Fax: (813) 3440-2727

**Latin America**
Latin America Regional Office
Lakeland, Florida, USA
Phone: (863) 619-7568
Fax: (863) 701-7131

# Maintenance and Service Parts/Related Literature

## Maintenance and Service Parts

Figure 1 identifies maintenance and service parts for your generator set. Obtain a complete list of maintenance and service parts from your authorized generator distributor/dealer.

| Part Description | Models | | | | |
|---|---|---|---|---|---|
| | 10EORDB<br>10EORZDB<br>9EFORDB<br>9EFORZDB | 15EORDB<br>15EORZDB<br>12.5EFORDB<br>12.5EFORZDB | 20EORDB<br>20EORZDB<br>16.5EFORDB<br>16.5EFORZDB | 30EORZDB<br>25EFORZDB | 40EORZDB<br>33EFORZDB |
| Air Cleaner Element | GM42265 | GM42265 | GM42266 | GM16944 | GM42266 |
| Belt | 225428 | 225428 | 225428 | GM46865 | GM46865 |
| Fuel Filter Element | GM32359 | GM32359 | GM32359 | GM32359 | GM32359 |
| Fuel/Water Separator Element | 225259 | 225259 | 225259 | 225259 | 225259 |
| Fuse, Auxiliary Winding (F1)<br>12 Lead Generator Sets (20 amp)<br>4 Lead Generator Sets (10 amp) | GM39266<br>223316 | GM39266<br>223316 | GM39266<br>223316 | | |
| Fuse, Relay Interface Board (F2) (10 amp) | 223316 | 223316 | 223316 | | |
| Fuse, Controller (F3) (10 amp) | 223316 | 223316 | 223316 | | |
| Fuse, SCR (F1) (10 amp) | | | | GM58256 | GM58256 |
| Fuse, Radiator Fan 1 (F2) (25 amp) | | | | GM59206 | GM59206 |
| Fuse, Radiator Fan 2 (F3) (25 amp) | | | | GM59206 | GM59206 |
| Fuse, Battery (F4) (10 amp) | | | | GM58921 | GM58921 |
| Fuse, Sub Relay (F5) (10 amp) | | | | GM58921 | GM58921 |
| Fuse, Battery Charging Alternator (F6) (10 amp) | | | | GM58921 | GM58921 |
| Oil Filter | 252834 | GM47465 | 252834 | GM47465 | GM47465 |
| Spray Paint (Black) | 221292 | 221292 | 221292 | 221292 | 221292 |

**Figure 1** Maintenance and Service Parts

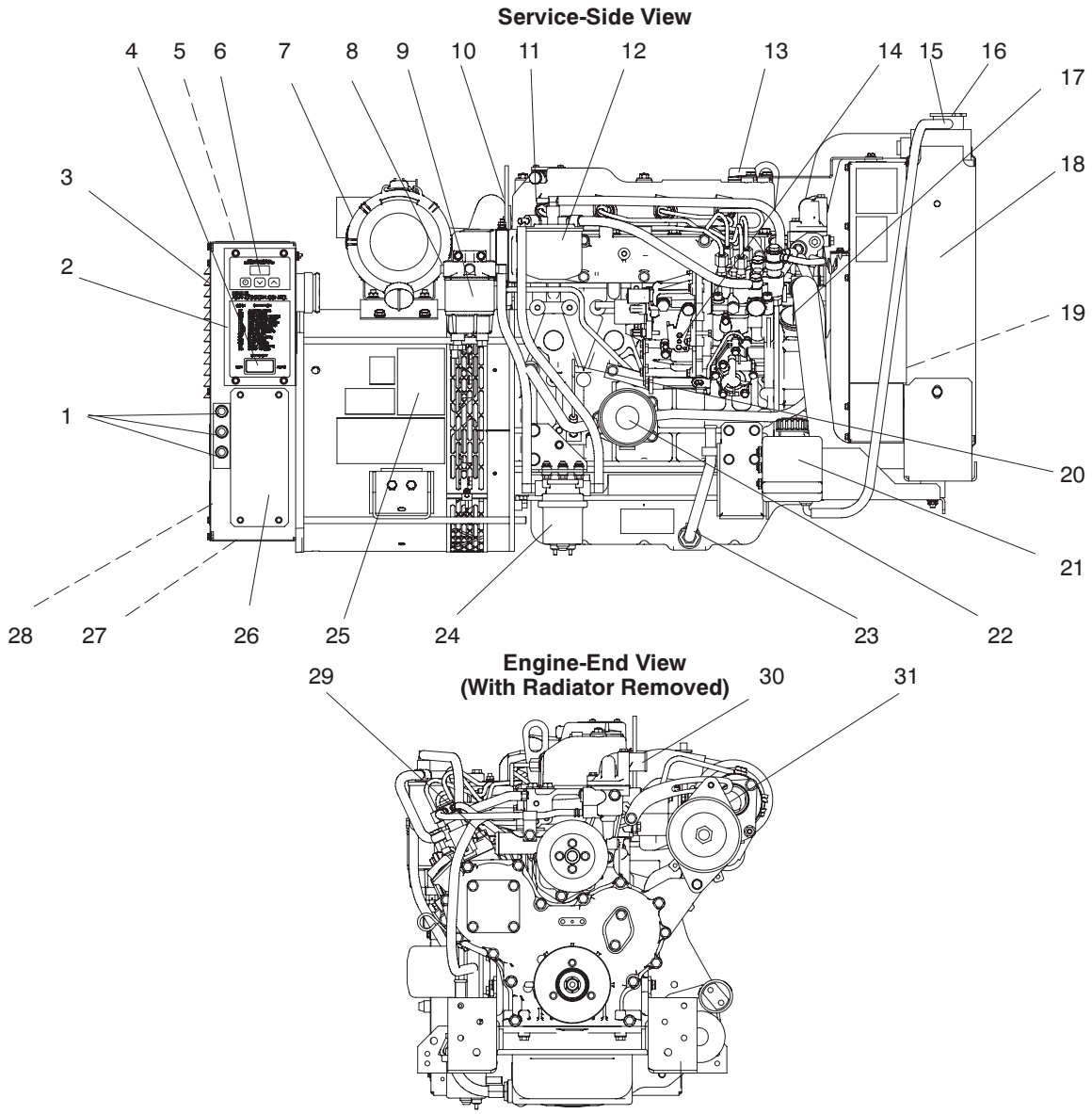
## List of Related Literature

Figure 2 identifies related literature available for the generator sets covered in this manual. Only trained and qualified personnel should install or service the generator set.

| Literature Type | Part Number |
|---|---|
| Installation Manual | TP-6552 |
| Operation Manual (Generator) | TP-6551 |
| Operation Manual (Engine) | TP-6596 |
| Parts Catalog* | TP-6554 |
| Service Manual (Generator) | TP-6553 |
| Service Manual (Engine) | TP-6597 |

* One manual combines Generator and Engine information.

**Figure 2** Generator Set Literature




1. Fuses (F1, F2, and F3) for 10/15/20EOR(Z)DB and 9/12.5/16.5EFOR(Z)DB models
2. Advanced Digital Control (ADC 2100)
3. Alternator cooling air inlet
4. Run-Off/Reset-Auto switch
5. Fuse block (inside junction box) for 30/40EORZDB and 25/33EFORZDB models
6. Runtime hour display
7. Air intake silencer/cleaner
8. Fuel inlet connection
9. Fuel/water separator
10. Lifting eye
11. Fuel return connection
12. Fuel filter
13. Oil fill (engine top)
14. Mechanical governor
15. Coolant overflow tube
16. Pressure cap (at radiator)
17. Oil fill (front gear cover)
18. Radiator
19. V-belt
20. Oil check/dipstick
21. Coolant overflow bottle
22. Lube oil filter
23. Oil drain
24. Fuel feed pump
25. Nameplate
26. Circuit breaker location
27. Remote customer interface connector
28. Load lead connection
29. Water inlet connection
30. Water outlet connection
31. Exhaust outlet

ADV7031-A

**Figure 1-1** Service Views, Typical

# Notes

## 2.1 Prestart Checklist

To ensure continued satisfactory operation perform the following checks or inspections before or at each startup, as designated, and at the intervals specified in the service schedule. In addition, some checks require verification after the unit starts.

**Air Cleaner.** Check for a clean and installed air cleaner element to prevent unfiltered air from entering the engine.

**Air Inlets.** Check for clean and unobstructed air inlets.

**Air Shrouding.** Check for securely installed and positioned air shrouding.

**Battery.** Check for tight battery connections. Consult the battery manufacturer's instructions regarding battery care and maintenance.

**Coolant Level.** Check the coolant level according to the cooling system maintenance information.

**Note: Block heater damage.** The block heater will fail if the energized heater element is not immersed in coolant. Fill the cooling system before turning on the block heater. Run the engine until it is warm, and refill the radiator to purge the air from the system before energizing the block heater.

**Drive Belt(s).** Check the belt condition and tension of the water pump and battery charging alternator belt(s).

**Exhaust System.** Check for exhaust leaks and blockages. Check the muffler and piping condition and check for tight exhaust system connections.

Inspect the exhaust system components for cracks and corrosion (exhaust manifold, exhaust line, exhaust clamps, and muffler).

- Check for corroded or broken metal parts and replace them as needed.
- Check for loose, corroded, or missing clamps and hangers. Tighten or replace the exhaust clamps and/or hangers as needed.
- Check that the exhaust outlet is unobstructed.
- Check the exhaust gas color. If the exhaust is blue or black, contact your local distributor/dealer.
- Visually inspect the exhaust system for exhaust leaks *(blowby)*. Check for carbon or soot residue on exhaust components. Carbon and soot residue indicates an exhaust leak. Seal leaks as needed.
- Ensure that the carbon monoxide detector is (1) in the vehicle, (2) functional, and (3) energized whenever the generator set operates.

**For your safety: Never operate the generator set without a functioning carbon monoxide detector(s) for your safety and the safety of others.**

**Fuel Level.** Check the fuel level and keep the tank(s) full to ensure adequate fuel supply.

**Oil Level.** Maintain the oil level at or near, not over, the full mark on the dipstick.

**Operating Area.** Check for obstructions that could block the flow of cooling air. Keep the air intake area clean. Do not leave rags, tools, or debris on or near the generator set.

## 2.2 Angular Operation

See Figure 2-1 for angular operation limits.

| Continuous | Intermittent— 3 minutes or less |
|---|---|
| 25° | 30° |
| Maximum value for all directions | |

**Figure 2-1** Angular Operation

## 2.3 Load Profile

Whenever operating the generator set, Kohler Co. recommends maintaining the minimum load profile indicated in Figure 2-2. Maintaining the load profile prevents corrosion formation on internal engine components when they're exposed to the breakdown of exhaust gases.

| Minimum Load Requirement | Ideal Load Requirement |
|---|---|
| 30% load | 70% load or more |

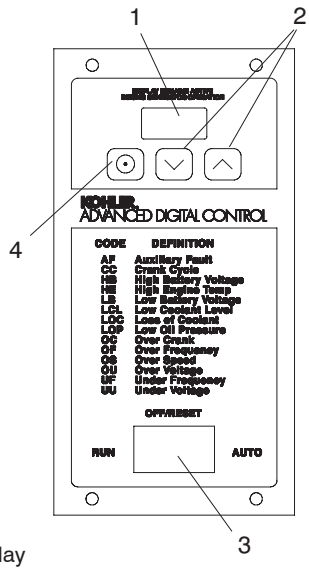
**Figure 2-2** Load Profile

The operator should perform all of the prestart checks. Start the generator set according to the starting procedure in the controller section of this manual. While the generator set is operating, listen for a smooth-running engine and visually inspect the generator set for fluid or exhaust leaks.

## 2.4 Advanced Digital Control Operation

Figure 2-3 illustrates the user interface on the Advanced Digital Control (ADC 2100).

**Note:** Have setup and adjustments of the ADC 2100 performed only by an authorized Kohler distributor/dealer. The setup and adjustments are password protected.




GM28707A-C

1. LED display
2. Up and down arrow buttons (use for setup and adjustment only)
3. Generator set master switch
4. Select button (use for setup and adjustment only)

**Figure 2-3** ADC 2100 Control

### 2.4.1 Controls and Indicators

Figure 2-4 describes the controls and indicators located on the controller. The LED display indicates generator set status as shown in Figure 2-4. The display is activated by a start or run command and remains active until the generator set master switch is moved to the OFF/RESET position or the power to the controller is removed.

The buttons on the controller keypad are used only for system configuration and adjustment. The controller is factory-set and should not require configuration or adjustment under normal operating conditions. If the generator set is reconnected to a different voltage and/or frequency, refer to an authorized Kohler distributor/dealer for system configuration and adjustment instructions.

| Control or Indicator | Item | Description |
|---|---|---|
| LED display | Runtime hours | Displays total generator set runtime hours. |
| | Crank indication | Displays CC_1, CC_2, or CC_3 to indicate the first, second or third attempt to start the engine. The last digit flashes during the crank cycle rest periods. |
| | Fault codes | Flashes a 2- or 3-letter fault code to indicate various fault conditions. See Section 2.4.5. |
| | Software version | See the Generator Set Installation Manual. |
| Keypad | Select and arrow buttons | The keypad is used for controller setup and adjustment only. Have setup and adjustments performed only by an authorized distributor/dealer. The setup and adjustment functions are password-protected. |
| Generator set master switch | Three-position switch | Switch functions as the generator set operation and controller reset switch. |

**Figure 2-4** ADC 2100 Controls and Indicators

### 2.4.2 Starting the Generator Set

The following procedures describe the actions required to start the generator set.

| Step | Action |
|---|---|
| 1 | **Fuel shut-off valve.**<br>Open the manual fuel shut-off valve, if equipped. |
| 2 | **Starting.**<br>Place the generator set master switch in the RUN position. |

The controller attempts to start the generator set three times. If the generator set does not start in three attempts, the system shuts down on an overcrank fault.

**Local Starting.**

Move the generator set master switch to the RUN position. The ADC 2100 attempts to start the generator set in three crank cycles (crank cycle time is pre-programmed).

**Remote Starting.**

Move the generator set master switch to the AUTO position to allow startup by the ATS, remote start/stop switch or remote digital gauge. A remote start/stop switch or digital gauge can be connected to the customer interface connection (P21 connector, leads 3 and 4. See the wiring diagrams in Section 5). See Section 2.4.4.

**Note:** The ADC 2100 allows three crank cycle attempts before the overcrank shutdown occurs.

### 2.4.3 Stopping the Generator Set

The following procedures describe the actions required to stop the generator set.

**Local Stopping.**

1. Run the generator set at no load for at least 2 minutes to ensure adequate engine cooldown.
2. Move the generator set master switch to the OFF/RESET position. The engine stops.

**Remote Stopping.**

1. Run the generator set at no load for at least 2 minutes to ensure adequate engine cooldown.
2. With the generator set master switch in the AUTO position, the generator set stops when the remote start/stop switch contacts close momentarily. See Section 2.4.4

### 2.4.4 Power Modes

The ADC 2100 controller's communication parameter can be set for three different power modes:

**Note:** Consult an authorized Kohler dealer/distributor for parameter adjustments.

- **Continuous power mode.** The ADC 2100 is powered continuously to allow communication with the remote gauge at all times. In this configuration, use the remote gauge for remote start and stop as well as generator set monitoring. A battery charger is recommended to maintain the battery.

**Note:** The controller is powered by the generator set engine starting battery. Remote communications require an active (powered-up) controller. Be advised that the ADC consumes 250 mA when the master switch is in the AUTO position. If you do not plan to use your generator set for a long period of time, Kohler recommends moving the master switch to the OFF/RESET position (0 mA draw).

- **One-hour power down mode.** The ADC 2100 powers down after 1 hour of inactivity. In this mode, use a remote start/stop switch or the generator set master switch to activate the controller after it has powered down. The remote gauge is powered during generator set crank and run only. In this configuration, the drain on the battery is reduced but the remote gauge cannot be used for remote start/stop. Install a separate start/stop switch if remote start/stop capability is required.
- **48-hour power down mode.** If the ADC 2100 is **not** configured for a CAN gauge, the controller will power down after 48 hours of inactivity. If the generator set has been started, the controller will power down 48 hours after the generator set stops.

### 2.4.5 Fault Shutdowns

The generator set shuts down automatically under the fault conditions listed in Figure 2-5 and the controller displays a fault code. The generator set cannot be restarted until the fault condition is corrected and the controller is reset. See Section 2.4.6 to reset the controller after a fault shutdown. The controller resets automatically after a battery voltage fault condition is corrected.

Shutdown switches on the generator set automatically reset when the problem is corrected. The high engine temperature switch automatically resets when the generator set cools. However, the fault does not clear until the controller is reset.

The controller displays a fault code but the generator set does not shut down under the conditions shown in Figure 2-6.

| Code | Fault | Description | Check |
|---|---|---|---|
| AF | Auxiliary fault input shutdown | Input from a customer-supplied switch that closes when the fault is active. Shutdown occurs 0.3 seconds after the fault is detected and will not start when the fault is active (input is grounded). This protection becomes active 3-seconds after crank disconnect. | Check the cause of the auxiliary fault. |
| HE | High engine temperature shutdown | Shutdown occurs if the engine coolant temperature exceeds the maximum temperature for more than 5 seconds. This protection becomes active after the engine reaches the crank disconnect speed.<br>**Note:** The high engine temperature shutdown functions only when the coolant level is in the operating range. | Check for a low engine coolant level. |
| LOC | Loss of coolant shutdown | Not used. | |
| LOP | Low oil pressure shutdown | Shutdown occurs if a low oil pressure condition exists for more than 5 seconds. This protection becomes active 30 seconds after the engine has reached crank disconnect speed (30 second inhibit).<br>**Note:** The low oil pressure shutdown does not protect against low oil level. Check the oil level at the engine. | Check for leaks in the lubrication system.<br>Check the oil level and add oil if the level is low. |
| OC | Overcrank shutdown | Shutdown occurs after 3 unsuccessful starting attempts. The crank cycle is set for three starting attempts. | Check the fuel supply and battery.<br>If there is no output voltage, check the line circuit breaker. Also check for loose connections.<br>Contact an authorized distributor/dealer for service if problem continues. |
| OF | Overfrequency shutdown | Shutdown occurs when the governed frequency exceeds 110% of the system's frequency setpoint for more than 5 seconds. This protection becomes active 10 seconds after engine start (10 second inhibit). | Contact an authorized distributor/dealer for service if problem continues. |
| OS | Overspeed shutdown | Shutdown occurs if the engine speed exceeds 115% of the normal running speed for more than 0.3 seconds. | Contact an authorized distributor/dealer for service if problem continues. |
| OU | Overvoltage shutdown | Shutdown occurs if the voltage exceeds 120% of the voltage regulator setpoint for more than 2 seconds. | Contact an authorized distributor/dealer for service if problem continues. |
| UF | Underfrequency shutdown | Shutdown occurs when the governed frequency falls below 90% of the system's frequency setpoint for more than 5 seconds. This protection becomes active 10 seconds after engine start (10-second inhibit). | Reduce the load and restart the generator set.<br>Contact an authorized distributor/dealer for service if problem continues. |
| UU | Undervoltage shutdown | Shutdown occurs if the voltage falls below 80% of the voltage regulator setpoint for more than 10 seconds. | Reduce the load and restart the generator set.<br>Contact an authorized distributor/dealer for service if problem continues. |
| SCF0 | Controller error | Indicates a software or communication problem within the ADC 2100. | Contact an authorized distributor/dealer for service. Controller needs to be replaced. |

**Figure 2-5** ADC 2100 Fault Shutdown Codes

| Code | Fault | Description | Check |
|---|---|---|---|
| HB | High battery voltage warning | Fault code is displayed if the engine starting battery voltage rises above 16 VDC for a 12 VDC system or above 30 VDC for a 24 VDC system for more than 2 seconds when the engine is not running. This fault condition does not inhibit engine starting.<br>The fault condition clears when the battery voltage returns to a voltage within the limits for more than 2 seconds. | Check the battery rating and condition. |
| LB | Low battery voltage warning | Fault code is displayed if the engine starting battery voltage falls below 9.5 VDC for a 12 VDC system or below 16 VDC for a 24 VDC system for more than 2 seconds when the engine is not running. This fault condition does not inhibit engine starting.<br>The fault condition clears when the battery voltage returns to a voltage within the limits for more than 2 seconds. | Check the battery rating and condition.<br>Charge or replace the battery. |

**Figure 2-6** ADC 2100 Fault Warning Codes

### 2.4.6 Resetting the Controller after a Fault Shutdown

Always identify and correct the cause of a fault shutdown before resetting the controller. Use the following procedure to reset the generator set controller after a fault shutdown.

1. Move the generator set master switch to the OFF/RESET position.
2. Disconnect the generator set from the load using the line circuit breaker or ATS. See the safety precautions at the beginning of this manual before proceeding.
3. Identify and correct the cause of the fault shutdown. See the safety precautions at the beginning of this manual before proceeding. Refer to Section 4, Troubleshooting.
4. Start the generator set by moving the generator set master switch to RUN. Test operate the generator set to verify that the cause of the shutdown has been corrected.
5. Shut the generator off by moving the generator set master switch to the OFF/RESET position.
6. Reconnect the generator set to the load using the line circuit breaker or ATS.
7. Move the generator set master switch to the AUTO position for startup by remote transfer switch or remote start/stop switch.

   **Note:** The controller's LED display remains off until an engine start command is received.

**Opening and closing the remote start/stop contact also resets the controller.**

## 2.5 Circuit Protection

If the generator set circuit breaker trips or the fuses blow repeatedly, see Section 4, Troubleshooting, for possible causes.

### 2.5.1 Line Circuit Breaker

A circuit breaker interrupts the generator output in the event of a fault in the wiring between the generator and the load. The line circuit breaker location is shown in Figure 1-1. If the circuit breaker trips, reduce the load and switch the breaker back to the ON position.

### 2.5.2 Fuses (10/15/20EOR(Z)DB and 9/12.5/16.5EFOR(Z)DB Models)

The junction box contains three inline fuses. See Figure 1-1 for locations. Always identify and correct the cause of a blown fuse before restarting the generator set. Refer to section 4, Troubleshooting, for conditions that may indicate a blown fuse. Obtain service from an authorized distributor/dealer.

**Controller Fuse.** A replaceable 10-amp fuse protects the controller circuitry. If the controller display is dark, check the battery and battery connections and then check the controller fuse. Replace the fuse if it is blown.

**Relay Fuse.** A replaceable 10-amp fuse protects the engine relays. If the generator set does not crank, check the battery and battery connections and then check the relay fuse. Replace the fuse if it is blown.

**Auxiliary Winding Fuse.** A replaceable 10-amp fuse for 4 lead generator sets (20 amp fuse for 12 lead generator sets) protects the alternator.

### 2.5.3 Fuse Block (30/40EORZDB and 25/33EFORZDB Models)

The junction box contains the fuse block. See Figure 1-1 for locations. Always identify and correct the cause of a blown fuse before restarting the generator set. Refer to section 4, Troubleshooting, for conditions that may indicate a blown fuse. Obtain service from an authorized distributor/dealer. See Figure 2-7.

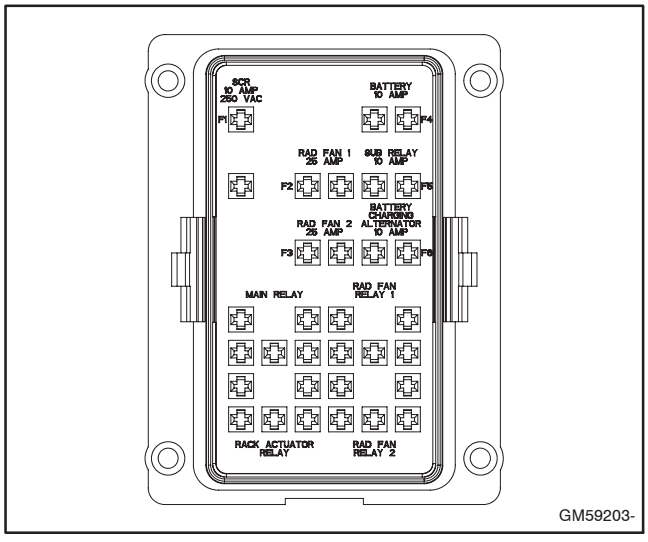



**Figure 2-7** Fuse Block (30/40EORZDB and 25/33EFORZDB)

# Notes

## 3.1 General Maintenance

**⚠ WARNING**

**Accidental starting.**
**Can cause severe injury or death.**

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

**Disabling the generator set. Accidental starting can cause severe injury or death.** Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

**⚠ WARNING**

**Hazardous voltage. Moving parts.**
**Can cause severe injury or death.**

Operate the generator set only when all guards and electrical enclosures are in place.

**Servicing the generator set when it is operating. Exposed moving parts can cause severe injury or death.** Keep hands, feet, hair, clothing, and test leads away from the belts and pulleys when the generator set is running. Replace guards, screens, and covers before operating the generator set.

**Note:** The engine and generator set may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of the bolt heads and nuts.

See the Safety Precautions and Instructions at the beginning of this manual before attempting to service, repair, or operate the generator set. Have an authorized distributor/dealer perform generator set service.

**Engine Service.** Perform generator set engine service at the intervals specified by the engine operation manual.

**Generator Set Service.** Perform generator set service at the intervals specified by the generator set operation manual.

If the generator set operates under dusty or dirty conditions, use *dry* compressed air to blow dust out of the alternator. With the generator set running, direct the stream of air in through the cooling slots at the alternator end.

**Routine Maintenance.** Refer to the following generator set service schedule, the engine service schedule, and the runtime hours shown on the ADC 2100 to determine when to schedule routine maintenance. Service more frequently generator sets that are subject to extreme weather or dusty or dirty conditions.

**Service Log.** Use the Operating Hour Service Log located in the back of this manual to document performed services.

**Service Schedule.** Perform maintenance on each item in the service schedule at the designated intervals for the life of the generator set. For example, an item requiring service every 100 hours or 3 months also requires service after 200 hours or 6 months, 300 hours or 9 months, and so on.

## 3.2 Service Schedule

| Perform Service at Intervals Indicated (X) | Reference Section | Daily | Every 50 Hrs. or 1 Month | Every 250 Hrs. or 3 Months | Every 500 Hrs. or 6 Months | Every 1000 Hrs. or Yearly |
|---|---|---|---|---|---|---|
| **FUEL SYSTEM** | | | | | | |
| Check the fuel level and fill as necessary | 2.1 | X (Before operation) | | | | |
| Check for any unusual noise † | | X (During operation) | | | | |
| Remove the sediment from the fuel tank and drain the fuel tank † | | | | X | | |
| Bleed the fuel system (if encountering hard starting) | 3.4.4 | | X | | | |
| Replace the fuel filter element | 3.4.2 | | | | X | |
| Fuel/water separator draining † | 3.4.3 | | X | | | |
| Fuel/water separator cleaning † | 3.4.3 | | | | X | |
| Inspect the fuel injection nozzle pressure †‡ | Eng. S/M | | | | | X |
| Adjust the fuel injection timing †‡ | Eng. S/M | | | | | X (2000 hrs. or 2 yrs.) |
| Inspect and adjust the fuel injection pump †‡ | Eng. S/M | | | | | X (2000 hrs. or 2 yrs.) |
| **LUBRICATION SYSTEM** | | | | | | |
| Check the crankcase oil level and add oil as necessary | 3.3 | X (Before operation) | | | | |
| Replace the oil in the crankcase | 3.3 | | X (Break-in period) | X | | |
| Replace the lube oil filter element | 3.3 | | X (Break-in period) | X | | |
| **COOLING SYSTEM** | | | | | | |
| Check the coolant level and fill as necessary | 3.7 | X (Before operation) | | | | |
| Adjust the water pump belt tension † | 3.7 | | | X | | |
| Clean the radiator fins and inspect the hoses † | 3.7 | | | X | | |
| Replace the coolant † | 3.7 | | | | | X |

† Consult your local distributor/dealer for service

‡ Read the WARNING found at the beginning of the manual regarding moving parts

## Service Schedule, continued

| Perform Service at Intervals Indicated (X) | Reference Section | Daily | Every 50 Hrs. or 1 Month | Every 250 Hrs. or 3 Months | Every 500 Hrs. or 6 Months | Every 1000 Hrs. or Yearly |
|---|---|---|---|---|---|---|
| **INTAKE/EXHAUST SYSTEM** | | | | | | |
| Inspect the exhaust system components † | 3.6 | X (Before operation) | | | | |
| Check the exhaust gas condition. If the exhaust is blue or black, contact your local distributor/dealer | 3.6 | X (During operation) | | | | |
| Replace the air cleaner element | 3.5 | | | | X | |
| Check the breather pipe for obstructions † | 3.5 | | | | X | |
| Clean the turbocharger blower, if equipped † | Eng. S/M | | | | | X |
| **ELECTRICAL SYSTEM** | | | | | | |
| Keep the battery charged and in good condition § | 3.9 | X (Before operation) | | | | |
| Check/adjust the alternator driving belt tension | 3.8 | | X (Break-in period) | X | | |
| Check and tighten the electrical connections | | | X | | | |
| Clean the battery cables † | | | | | | X |
| **ENGINE AND MOUNTING** | | | | | | |
| Check for water, fuel, coolant, and oil leakage †‡ | | X (After operation) | | | | |
| Retighten any loose nuts and bolts | | X (Before operation) | | | | |
| Check the mounting bolts/vibromounts and tighten if necessary | | | | | X | |
| Adjust the intake/exhaust valve clearance † | Eng. S/M | | | | | X |
| Check the compartment condition (fuel, oil, or water leaks) | | X (Before operation) | | | | |
| **REMOTE START PANEL** | | | | | | |
| Check the remote start panel operation, if equipped | | | X (Break-in period) | | | X |
| **GENERATOR** | | | | | | |
| Test run the generator set | | | X (Weekly) | | | |
| Blow dust out of the generator † | 3.1 | | | | | X |
| Clean the slip rings and inspect the brushes, if equipped † | Gen. S/M | | | | | X |

† Consult your local distributor/dealer for service

‡ Read the WARNING found at the beginning of the manual regarding moving parts

§ Consult the battery manufacturer's instructions

## 3.3 Lubrication System

See the Scheduled Maintenance section for oil change and oil filter replacement intervals. See Section 1 for the oil drain, oil check, oil fill, and oil filter locations.

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### 3.3.1 Oil Specifications

Use oil that meets the American Petroleum Institute (API) classification of CD or CF. Using an unsuitable oil or neglecting an oil change may result in damage and a shorter engine life. Figure 3-1 shows the recommended Society of Automotive Engineers (SAE) viscosity designation for given operating temperature ranges.

**Note:** Failure to observe the oil specifications may cause inadequate lubrication/oil pressure and cold-starting difficulties.

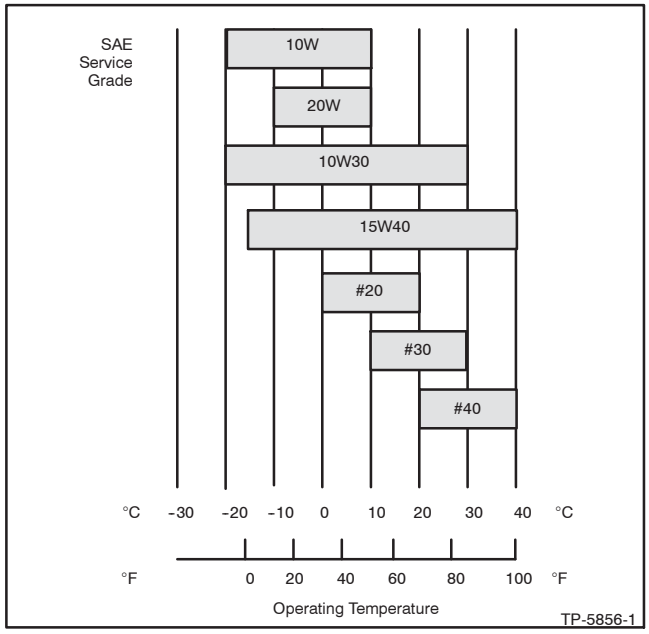
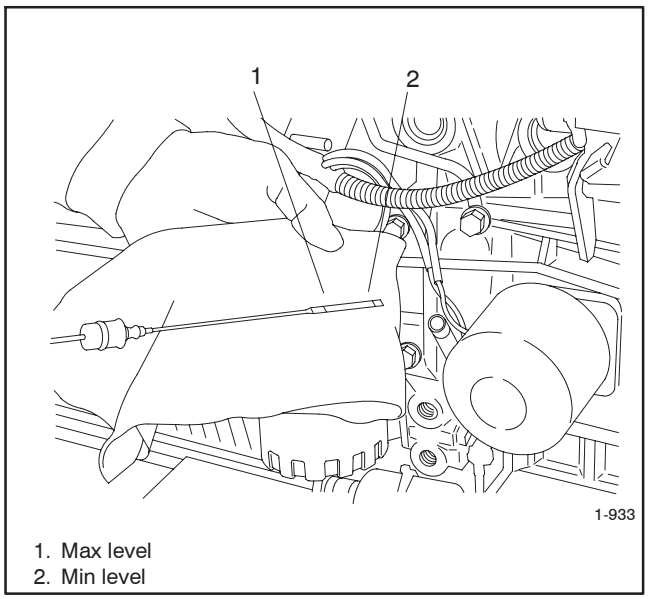



**Figure 3-1** Engine Oil Selection

### 3.3.2 Oil Check

Check the oil level in the crankcase daily or before each startup to ensure that the level is in the safe range. To check the oil level, remove the dipstick and wipe the end clean, reinsert as far as possible, and remove. Maintain the oil level between the Min and Max marks on the dipstick, as shown in Figure 3-2. See Section 1 for dipstick location.




1. Max level
2. Min level

**Figure 3-2** Oil Level Check

**Note:** Do not operate the set if the oil level is below the Min mark or above the Max mark.

### 3.3.3 Oil Change

Change the oil more frequently if the generator operates under dirty, dusty conditions. See Figure 3-3 for oil capacities.

| Model | L (Qts.) |
|---|---|
| 10EOR(Z)DB<br>9EFOR(Z)DB | 3.6 (3.8) |
| 15EOR(Z)DB<br>12.5EFOR(Z)DB | 4.7 (5.0) |
| 20EOR(Z)DB<br>16.5EFOR(Z)DB | 5.8 (6.1) |
| 30EORZDB<br>25EFORZDB | 10.2 (10.8) |
| 40EORZDB<br>33EFORZDB | 10.2 (10.8) |

**Figure 3-3** Oil Capacities

#### Oil Change Procedure

Whenever possible, drain the oil while it is still warm.

1. **Drain the oil.**
   a. Place the generator set master switch in the OFF position.
   b. Disconnect the power to the battery charger, if equipped.
   c. Disconnect the generator set engine starting battery, negative (–) lead first.
   d. Place an oil collection container below the oil drain and remove the oil drain plug.
   e. Allow time for the engine oil to drain completely.
   f. Replace the oil drain plug.
2. **Replace the oil filter.**
   a. Remove the oil filter by rotating it counterclockwise with an oil filter wrench.
   b. Apply a light coat of clean oil to the rubber seal of the new oil filter.
   c. Install the new oil filter following the instructions provided with the filter.

   **Note:** Dispose of all waste materials (engine oil, fuel, filter, etc.) in an environmentally safe manner.
3. **Fill with oil.** Add new oil of the weight, grade, and quantity specified in Section 3.3.
4. **Check for leaks.**
   a. Check that the generator set master switch is in the OFF position.
   b. Reconnect the generator set engine starting battery, negative (–) lead last.
   c. Reconnect the power to the battery charger, if equipped.
   d. Start the generator set and check for leaks around the oil filter.
   e. Stop the generator set and tighten the oil filter to stop any leaks.

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## 3.4 Fuel System

### 3.4.1 Fuel Specifications

Use a clean, good quality diesel fuel oil with a cetane number of 45 or greater. Clean fuel prevents the diesel fuel injectors and pumps from clogging.

| Fuel Recommendations | |
|---|---|
| United States | No. 2-D, No. 1-D, ASTM D975-94 |
| United Kingdom | BS 2869-A1 or A2 |
| European Union | EN590:96 |
| Japan | JIS. No. K2204-2 |

**Note:** Never store diesel fuel in galvanized containers; diesel fuel and the galvanized coating react chemically to produce flaking that quickly clogs filters or causes fuel pump or injector failure.

**Note:** Avoid storing fuel for more than one month. Take special precautions to keep all dirt, water, and other contaminants out of fuel to prevent the growth of microbes. Microbes form slime that clogs the fuel filter and lines.

**Note:** Do not run the generator set out of fuel because the fuel lines will draw in air and necessitate bleeding the fuel system before restarting the unit.

## 3.4.2 Fuel Filter

The quality and condition of the fuel largely determine the filter's useful life. Replace the fuel filter element as listed in the service schedule. Section 1 shows the typical location of a fuel filter. Use the applicable procedure below to replace the fuel filter.

### Fuel Filter Cleaning/Replacement Procedure

1. Close the fuel supply valve.
2. Loosen the fuel filter by turning it counterclockwise. Remove the fuel filter and use rags to clean up spilled fuel oil. Dispose of the fuel filter in an approved manner.
3. Clean the contact surface of the fuel oil filter adapter.
4. Lightly lubricate the gasket surface of the new fuel filter with fresh fuel oil. Thread the filter on the adapter until the gasket makes contact; hand-tighten the filter an additional one-half turn. Wash hands after any contact with fuel oil.
5. Open the fuel supply valve.
6. Bleed the system. See Section 3.4.4, Bleeding the Fuel System.

## 3.4.3 Fuel/Water Separator

These model generator sets includes a fuel/water separator. The fuel/water separator helps to remove water and sediment from the fuel system.

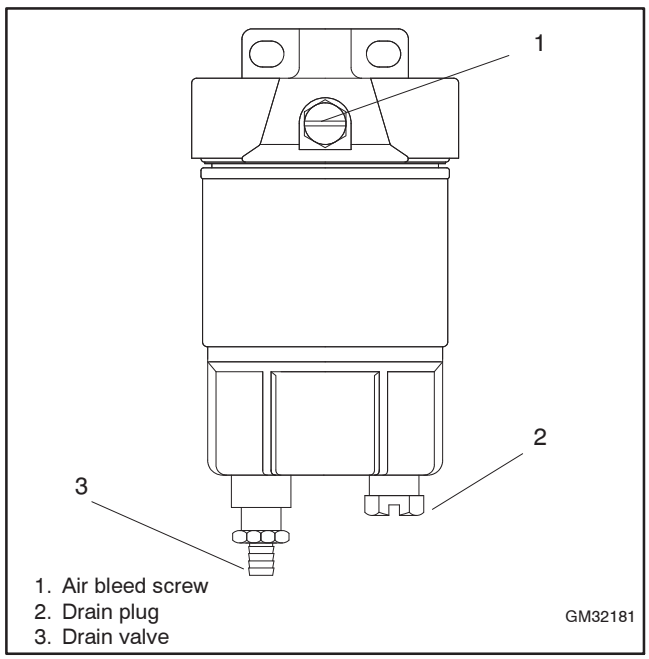



**Figure 3-4** Fuel/Water Separator

### Fuel/Water Separator Draining Procedure

At the interval specified in the service schedule, drain the water from the fuel/water separator. Hold a suitable container beneath the fuel/water separator and push up on the drain valve. See Figure 3-4. Release the valve when fuel (free of water) flows from the fuel/water separator.

### Fuel/Water Separator's Element Replacement Procedure

At the interval specified in the service schedule, replace the fuel/water separator element.

1. Close the fuel valve at the nearest point to the water filter inlet or at the fuel tank.
2. Remove the water drain plug (or push up the drain valve) and allow water and fuel to flow into a suitable container.

**Note:** Depending upon the location of the fuel valve, a considerable amount of fuel may drain out.

3. Remove the separator's element from the mounting head by twisting in a counterclockwise direction.
4. Remove the bowl from the fuel/water separator element. Wipe the excess fuel from the bowl and the O-ring. Do not discard the bowl or O-ring.
5. Inspect the components for wear or damage. Replace parts as necessary.
6. Lubricate the O-ring with clean diesel fuel and replace it in the bowl.
7. Install the bowl onto a new fuel/water separator filter element.
8. Lubricate the bowl/element assembly with clean fuel. Install the bowl/element onto the filter mounting head.
9. Replace the water drain plug (if removed) and close the vent.
10. Remove the air bleed screw from the fuel/water separator.
11. Open the fuel supply valve.
12. After fuel fills the water separator, allow fuel to flow from the air bleed hole until all air is displaced (fuel flows free of air bubbles).
13. Replace the air bleed screw.

### 3.4.4 Bleeding the Fuel System

Bleed air from the fuel system to prevent starting failures and/or erratic operation. One or more of the following causes air to collect in the fuel system:

- Operating the generator set until it runs out of fuel.
- Developing air leaks in the plumbing between the fuel tank and the engine-mounted fuel pump.
- Replacing the fuel filter.

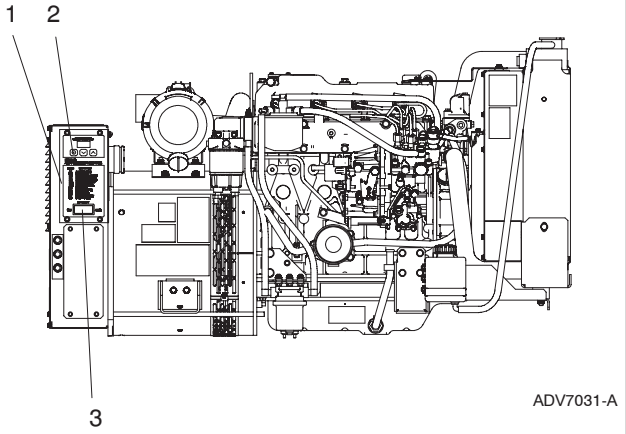
**Note:** If the ADC 2100 indicates an overcrank fault during this procedure, disconnect the negative wire from the fuel solenoid (allowing the fuel injection pump to fill with fuel) and repeat this procedure after allowing the starter motor to cool down.

**Note:** Have a rag handy during the bleeding procedure. Wipe up all spilled diesel fuel after bleeding the system. Wash hands after any contact with fuel oil.

**Note:** Do not crank the engine to prime the fuel system. Use the following procedure.

#### Fuel System Priming Procedure

1. Press and hold the Select button located on the ADC. See Figure 3-5.
2. Move the generator set master switch to the RUN position to enter the programming mode.
3. Continue to hold the Select button for 10 seconds. The ADC will display “Fuel” and the fuel priming pump will start.
4. Continue to hold the Select button for as long as you want the fuel priming pump to function (typically 10 seconds).
5. Release the Select button and move the Master switch to the OFF position.
6. Place the Master switch to the RUN position to start the unit.




1. ADC control
2. Select button
3. Generator set master switch

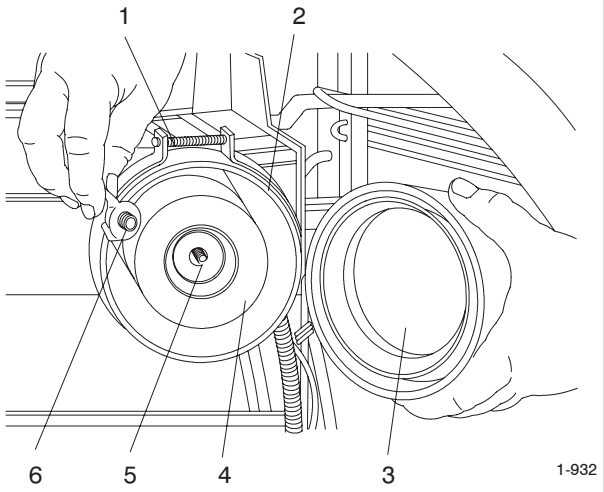
**Figure 3-5** ADC Control

## 3.5 Air Cleaner

At the interval specified in the service schedule, inspect, clean, *or replace* the air cleaner element. Clean the element more frequently if the generator operates in dirty, dusty conditions. Check the element for accumulated oil or dirt that could cause poor performance. Replace a damaged air cleaner element. Follow the procedure described below. At the time of service, clean the air cleaner breather pipe and remove all dust and foreign matter from the air cleaner housing.

### Air Cleaner Element Cleaning or Replacement Procedure

1. Loosen the eyebolt and clamp to remove the air cleaner cover.
2. Remove the wing nut and slide the air cleaner element from the threaded rod.
3. Tap the element lightly against a flat surface to dislodge loose surface dirt. Do not clean the element in any liquid or use compressed air as these will damage the filter element.
4. Wipe the cover and base with a clean rag to remove any dirt.
5. Ensure tight clamps at the inlet/outlet connections.
6. Install the air cleaner element on the threaded rod. Tighten the wing nut.
7. Position the cover with the arrow up; place the clamp over the base and cover and tighten the eyebolt.




1. Eyebolt/clamp
2. Base
3. Cover
4. Element
5. Threaded rod
6. Wing nut

**Figure 3-6** Air Cleaner Components

## 3.6 Exhaust System

**⚠ WARNING**

**Carbon monoxide.**
**Can cause severe nausea, fainting, or death.**

The exhaust system must be leakproof and routinely inspected.

**Inspecting the exhaust system. Carbon monoxide can cause severe nausea, fainting, or death.** For the safety of the vehicle's occupants, install a carbon monoxide detector. Never operate the generator set without a functioning carbon monoxide detector. Inspect the detector before each generator set use.

At the interval specified in the service schedule, inspect the exhaust system. See Section 1 for the exhaust outlet location.

**Inspection Points**

Check for exhaust leaks and blockages. Check the muffler and piping condition and check for tight exhaust system connections.

Inspect the exhaust system components for cracks and corrosion (exhaust manifold, exhaust line, exhaust clamps, and muffler).

- Check for corroded or broken metal parts and replace them as needed.
- Check for loose, corroded, or missing clamps and hangers. Tighten or replace the exhaust clamps and/or hangers as needed.
- Check that the exhaust outlet is unobstructed.
- Check the exhaust gas color. If the exhaust is blue or black, contact your local distributor/dealer.
- Visually inspect the exhaust system for exhaust leaks *(blowby)*. Check for carbon or soot residue on exhaust components. Carbon and soot residue indicates an exhaust leak. Seal leaks as needed.
- Ensure that the carbon monoxide detector is (1) in the vehicle, (2) functional, and (3) energized whenever the generator set operates.

**For your safety: Never operate the generator set without a functioning carbon monoxide detector(s) for your safety and the safety of others.**

## 3.7 Cooling System

**⚠ WARNING**

**Hot coolant and steam.**
**Can cause severe injury or death.**

Before removing the pressure cap, stop the generator set and allow it to cool. Then loosen the pressure cap to relieve pressure.

Allow the engine to cool. Release pressure from the cooling system before removing the pressure cap. To release pressure, cover the pressure cap with a thick cloth and then slowly turn the cap counterclockwise to the first stop. Remove the cap after pressure has been completely released and the engine has cooled. Check the coolant level at the tank if the generator set has a coolant recovery tank.

### 3.7.1 Checking the Cooling System

To prevent generator shutdown or damage because of overheating, keep the cooling air inlets clean and unobstructed at all times. Inspect the radiator's exterior for obstructions and remove dirt and foreign material with a soft brush or cloth to avoid damaging the radiator fins. Check the hoses and connections for leaks and replace any cracked, frayed, or spongy hoses. When checking the coolant level, also check the rubber seal of the radiator's pressure cap and replace a cracked or deteriorated cap. The pressure cap raises the boiling point of the coolant, enabling higher operating temperatures. If the cap leaks, replace it with the same rating type of cap. See Figure 3-7. Remove dirt and other debris from the pressure cap and filler neck. See Figure 3-8 for thermostat rating. See Figure 3-9 for coolant capacities.

| Pressure Cap Rating | |
|---|---|
| 10EOR(Z)DB and 9EFOR(Z)DB | 97 kPa (14 psi) |
| 15EOR(Z)DB and 12.5EFOR(Z)DB<br>20EOR(Z)DB and 16.5EFOR(Z)DB | 83–110 kPa (12–16 psi) |
| 30/40EORZDB and 25/33EFORZDB | 48 kPa (7 psi) |

**Figure 3-7** Pressure Cap Rating (For Inline Radiator Models)

| Thermostat Rating | |
|---|---|
| All Models | 82°C (179°F) |

**Figure 3-8** Thermostat Rating

| Model | Engine, L (Qts.) | Engine & Unit-Mounted Radiator, L (Qts.) |
|---|---|---|
| 10EOR(Z)DB<br>9EFOR(Z)DB | 1.8 (1.9) | 4.1 (4.3) |
| 15EOR(Z)DB<br>12.5EFOR(Z)DB | 2.0 (2.1) | 9.1 (9.6) |
| 20EOR(Z)DB<br>16.5EFOR(Z)DB | 2.7 (2.8) | 9.3 (9.8) |
| 30EORZDB<br>25EFORZDB | 4.2 (4.4) | 15 (16) |
| 40EORZDB<br>33EFORZDB | 4.2 (4.4) | 15.8 (16.7) |

**Figure 3-9** Coolant Capacities

### 3.7.2 Draining the Cooling System

The radiator contains a coolant drain valve to drain the cooling system. When draining the coolant, remove the radiator's pressure cap: this will allow the entire system to drain and will prevent air pockets from forming and restricting coolant passage to the block.

**Note:** Pay special attention to the coolant level. After the coolant drains, allow time for complete refill of the engine water jacket. Check the coolant level as described earlier.

### 3.7.3 Filling the Cooling System

1. Remove the radiator's pressure cap.
2. Close the radiator's and/or engine block's coolant drain valve(s) and tighten the hose clamps.

**Note:** Do not add coolant to a hot engine. Adding coolant to a hot engine can cause the cylinder block or cylinder head to crack. Wait until engine has cooled.

3. Fill the radiator with the recommended coolant mixture of 50% ethylene glycol and 50% clean, softened water to inhibit rust/corrosion and prevent freezing.

**Note:** A coolant solution of 50% ethylene glycol provides freezing protection to -37°C (-34°F) and overheating protection to 129°C (265°F). A coolant solution with less than 50% ethylene glycol may not provide adequate freezing and overheating protection. A coolant solution with more than 50% ethylene glycol can cause engine or component damage. Do not use alcohol or methanol antifreeze or mix them with the specified coolant. Consult the engine manufacturer's operation manual for engine coolant specifications.

4. Replace the radiator's pressure cap.
5. Operate the engine until the thermostat opens and the radiator upper hose becomes hot.
6. Stop the engine and allow it to cool.
7. Remove the radiator's pressure cap.
8. Add coolant to the radiator to just below the overflow tube on the filler neck.
9. Replace the radiator's pressure cap.
10. Maintain the coolant level in the coolant overflow bottle between the High and Low markings.

    **Note:** Periodically check the coolant level by removing the radiator's pressure cap. Do not rely solely on the level in the coolant overflow bottle. Add fresh coolant until the level is just below the overflow tube opening.

### 3.7.4 Flushing and Cleaning

For optimum protection, drain, flush, and refill the cooling system at the interval listed in the service schedule.

**Flushing and Cleaning Procedure**

1. Remove the pressure cap and open the radiator's coolant drain valve and let the system drain completely. Remove the pressure cap to simplify draining.
2. Drain, clean, and flush the coolant overflow bottle.
3. Flush the system with clean water.
4. Close the radiator's coolant drain valve.
5. Fill the system with the recommended coolant.
6. Replace the pressure cap.

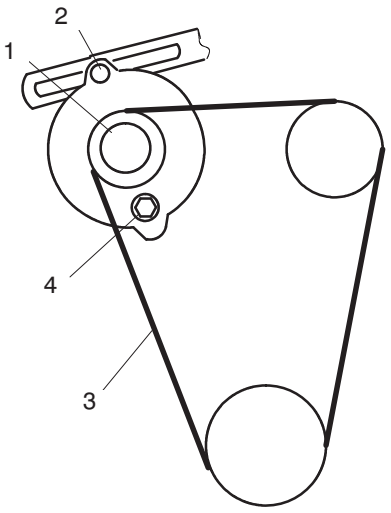
### 3.7.5 Pressure Cap

The cooling system utilizes a pressure cap to raise the boiling point of the coolant, enabling higher operating temperatures. If the cap leaks, replace it with a cap of the same rating.

## 3.8 Belt Check

Check the belt tension at the intervals specified in the service schedule. If the tension is not within specification, adjust as necessary using the following procedure.

Adjust the tension of the alternator/fan belt so that the belt can be depressed about 12.7 mm (0.5 in.) when applying finger pressure. Use the following procedure to adjust the belt.




1. Battery charging alternator pulley
2. Adjusting screw
3. Check the alternator belt tension here
4. Alternator pivot screw

**Figure 3-10** Belt Tension

**Belt Tensioning Procedure**

1. Disconnect the battery, negative lead first.
2. Loosen the pivot and adjusting screws.
3. While prying the battery charging alternator outward, tighten the adjusting screw.
4. Tighten the pivot screw.
5. Recheck and adjust as necessary.
6. Reconnect the battery, negative lead last.

   **Note:** Also check the fan belt for cracks or tears and replace the belt if necessary.

## 3.9 Battery

Consult the battery manufacturer's instructions regarding battery care and maintenance.

## 3.10 Storage Procedure

Perform the following storage procedure before taking a generator set out of service for three months or longer. Follow the engine manufacturer's recommendations, if available, for fuel system and internal engine component storage.

### 3.10.1 Lubricating System

Prepare the engine lubricating system for storage as follows:

1. Run the generator set for a minimum of 30 minutes to bring it to normal operating temperature.
2. Stop the generator set.
3. With the engine still warm, drain the oil from the crankcase.
4. Remove and replace the oil filter.
5. Refill the crankcase with oil suited to the climate.
6. Run the generator set for two minutes to distribute the clean oil.
7. Stop the generator set.
8. Check the oil level and adjust, if needed.

### 3.10.2 Cooling System

Prepare the cooling system for storage as follows:

1. Check the coolant freeze protection using a coolant tester.
2. Add or replace coolant as necessary to ensure adequate freezing protection. Use the guidelines included in the engine operation manual.
3. Run the generator set for 30 minutes to redistribute added coolant.

### 3.10.3 Fuel System

Prepare the fuel system for storage as follows:

**Diesel-Fueled Engines**

1. Fill the fuel tank with #2 diesel fuel.
2. Condition the fuel system with compatible additives to control microbial growth.
3. Change the fuel filter/separator and bleed the fuel system.

### 3.10.4 Exterior

Prepare the exterior for storage as follows:

1. Clean the exterior surface of the generator set.
2. Seal all engine openings except for the air intake with nonabsorbent adhesive tape.
3. To prevent impurities from entering the air intake and to allow moisture to escape from the engine, secure a cloth over the air intake.
4. Mask electrical connections.
5. Spread a light film of oil over unpainted metallic surfaces to inhibit rust and corrosion.

### 3.10.5 Battery

Perform battery storage after all other storage procedures.

1. Place the generator set master switch in the OFF position.
2. Disconnect the battery(ies), negative (–) lead first.
3. Clean the battery. Refer to the battery manufacturer for the battery cleaning procedure.
4. Place the battery in a cool, dry location.
5. Connect the battery to a float/equalize battery charger or charge it monthly with a trickle battery charger. Refer to the battery charger manufacturer's recommendations.

   Maintain a full charge to extend battery life.

# Section 4 Troubleshooting

This section contains generator set troubleshooting, diagnostic, and repair information.

Use the following charts as a quick troubleshooting reference. The table groups generator set faults and suggests likely causes and remedies. The table also refers you to more detailed information including sections of this manual, the generator set service manual (S/M), the generator set installation manual (I/M), and the engine service manual (Engine S/M) to correct the indicated problem.

Corrective action and testing often require knowledge of electrical and electronic circuits. To avoid additional problems caused by incorrect repairs, have an authorized service distributor/dealer perform service.

Maintain a record of repairs and adjustments performed on the equipment. If the procedures in this manual do not explain how to correct the problem, contact an authorized distributor/dealer. Use the record to help describe the problem and repairs or adjustments made to the equipment.

## 4.1 Fault Codes

The Advanced Digital Control displays fault codes to aid in troubleshooting. Fault codes, descriptions, and recommended actions are listed in Figure 2-5.

Identify and correct the cause of the fault condition. Then reset the controller after a fault shutdown. See Section 2.4.6.

## 4.2 Controller Troubleshooting

Figure 4-1 contains troubleshooting, diagnostic, and repair information for the Advanced Digital Control.

x:gt:001:002a:

| Problem | Possible Cause | Corrective Action |
|---|---|---|
| Controller LED display is off | No power to the controller: | |
| | Controller fuse (F3) is blown. | Replace the fuse. If the fuse blows again, contact the distributor/dealer. |
| | Low or no battery voltage. | Check connections.<br>Check generator set battery. |
| | Generator set master switch is in the OFF/RESET position. | Move generator set master switch to the AUTO or RUN position. |
| | Generator set master switch in AUTO but no start command has been received since last controller reset. | No action required. Controller display will activate when a remote start command is received or the generator set master switch is moved to the RUN position. Use the remote switch to start generator set and activate the controller display, if desired. |

**Figure 4-1** Controller Troubleshooting Chart

| Trouble Symptoms | | | | | | | | | | | Probable Causes | Recommended Actions | Section or Publication Reference* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Does not crank | Cranks but does not start | Starts hard | No or low output voltage | Stops suddenly | Lacks power | Overheats | Low oil pressure | High fuel consumption | Excessive or abnormal noise | No controller display | | | |
| **Controller** | | | | | | | | | | | | | |
| x | | | | x | | | | | | | Generator set master switch in the OFF position | Move the generator set master switch to the correct position (RUN or AUTO). | Section 2 |
| x | | | | x | | | | | | | **10-20EOR(Z)DB/9-16.5EFOR(Z)DB Models:** Controller fuse (F3) blown | Replace the blown controller fuse. If the fuse blows again, troubleshoot the controller.† | Section 2, W/D |
| x | | | | x | | | | | | | **10-20EOR(Z)DB/9-16.5EFOR(Z)DB Models:** The relay interface board fuse (F2) blown **30-40EORZDB/25-33EFORZDB Models:** The relay interface board fuse (F6) blown | Replace the blown relay interface board fuse. If the fuse blows again, troubleshoot the controller.† | Section 2, W/D |
| | | | | x | | | | | | | **10-40EOR(Z)DB/9-33EFOR(Z)DB Models:** The auxiliary winding fuse (F1) blown | Replace the blown auxiliary winding fuse. If the fuse blows again, troubleshoot the controller.† | Section 2, W/D |
| x | | | | x | | | | | | | Controller circuit breaker tripped | Reset the controller circuit breaker. | Section 2 |
| x | | | | | | | | | | | Controller master or start/stop switch inoperative | Replace the controller master switch. | — |
| | | | | x | | | | | | | Controller fault | Troubleshoot the controller.† | Gen. S/M |
| | | | | x | | | | | | | Remote stop command received from a remote switch or ATS | Check the remote switch position. | |
| | | | | | | | | | | x | **30-40EORZDB/25-33EFORZDB Models:** The battery fuse (F4) blown | Replace the blown auxiliary winding fuse. If the fuse blows again, contact an authorized distributor/dealer.† | Section 2, W/D |
| **Cooling System** | | | | | | | | | | | | | |
| | | | | | | x | | x | | | Air openings clogged | Clean the air openings. | — |
| | | | | x | | | | | | | High temperature shutdown | Allow the engine to cool down. Then troubleshoot the cooling system. | Sec. 3, Eng. O/M |
| | | | | x | | | | | | | Low coolant level shutdown | Restore the coolant to normal operating level. | Section 3 |
| | | | | | | x | | | | | Coolant level low | Restore the coolant to normal operating level. | Section 3 |
| | | | | | | x | | | | | Thermostat inoperative | Replace the thermostat. | Eng. S/M |
| | | | | | | x | | | | | Cooling water pump inoperative | Tighten or replace the belt. Replace the water pump. | Eng. O/M or S/M |
| | | | | | | x | | | | | **30-40EORZDB/25-33EFORZDB Models:** The radiator fan 1 fuse (F2) or the radiator fan 2 fuse (F3) blown (optional with enclosed, unit-mounted radiator) | Replace the blown auxiliary winding fuse. If the fuse blows again, contact an authorized distributor/dealer.† | Section 2, W/D |

* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram

† Have an authorized service distributor/dealer perform this service.

| Trouble Symptoms | | | | | | | | | | | Probable Causes | Recommended Actions | Section or Publication Reference* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Does not crank | Cranks but does not start | Starts hard | No or low output voltage | Stops suddenly | Lacks power | Overheats | Low oil pressure | High fuel consumption | Excessive or abnormal noise | No controller display | | | |
| **Electrical System (DC circuits)** | | | | | | | | | | | | | |
| x | x | | | | | | | | | | Battery connections loose, corroded, or incorrect | Verify that the battery connections are correct, clean, and tight. | Section 3 |
| x | x | | | | | | | | | | Battery weak or dead | Recharge or replace the battery. The spec sheet provides recommended battery CCA rating. | Section 3, S/S |
| x | | | | x | | | | | | | Engine harness connector(s) not locked tight | Disconnect the engine harness connector(s) then reconnect it to the controller. | W/D |
| | | | | x | | | | | | | Fault shutdown | Reset the controller. | Section 2 |
| x | x | | | | | | | | | | Starter/starter solenoid inoperative | Replace the starter or starter solenoid. | Eng. S/M |
| **Engine** | | | | | | | | | | | | | |
| | x | x | | | x | | | x | | | Air cleaner clogged | Clean or replace the filter element. | Section 2 |
| | x | x | | | | x | | x | x | | Compression weak | Check the compression.† | Eng. S/M |
| | | | x | | x | x | | x | x | | Engine overload | Reduce the electrical load. See the generator set installation manual for wattage specifications. | I/M |
| | | | | | | | | | x | | Exhaust system leak | Inspect the exhaust system. Replace the inoperative exhaust system components.† | Section 3, I/M |
| | | | | | | | | | x | | Exhaust system not securely installed | Inspect the exhaust system. Tighten the loose exhaust system components.† | Section 3, I/M |
| | | | | x | | | | | | | Overspeed shutdown | Reset the controller. If the overspeed fault occurs again, contact the distributor/dealer. | |
| | | | | | x | | | | x | | Valve clearance incorrect | Adjust the valves.† | Eng. S/M |
| | | | | | | | | | x | | Vibration excessive | Tighten all loose hardware. | — |
| x | x | | | | | | | | | | **30-40EORZDB/25-33EFORZDB Models:** The sub relay fuse (F5) blown | Replace the blown auxiliary winding fuse. If the fuse blows again, contact an authorized distributor/dealer.† | Section 2, W/D |

* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram

† Have an authorized service distributor/dealer perform this service.

| Trouble Symptoms | | | | | | | | | | | Probable Causes | Recommended Actions | Section or Publication Reference* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Does not crank | Cranks but does not start | Starts hard | No or low output voltage | Stops suddenly | Lacks power | Overheats | Low oil pressure | High fuel consumption | Excessive or abnormal noise | No controller display | | | |
| **Fuel System** | | | | | | | | | | | | | |
| | x | | | x | | | | | | | Fuel tank empty or fuel valve shut off | Add fuel and move the fuel valve to the ON position. | — |
| | x | x | | x | x | | | | | | Fuel filter restriction | Clean or replace the fuel filter. | Eng. O/M |
| | x | | | | | | | | | | Fuel solenoid inoperative | Troubleshoot the fuel solenoid.† | Eng. S/M |
| | x | x | | | x | | | | | | Air in fuel system (diesel only) | Bleed the diesel fuel system. | Eng. O/M |
| | x | x | | | x | | | | | | Fuel or fuel injectors dirty or faulty (diesel only) | Clean, test, and/or replace the inoperative fuel injector.† | Eng. S/M |
| | x | x | | | x | | | x | | | Fuel injection timing out of adjustment (diesel only) | Adjust the fuel injection timing.† | Eng. S/M |
| | x | | | | x | | | x | | | Fuel feed or injection pump inoperative (diesel only) | Rebuild or replace the injection pump.† | Eng. S/M |
| **Generator** | | | | | | | | | | | | | |
| | | | x | | | | | | | | AC output circuit breaker open | Reset the breaker and check for AC voltage at the generator side of the circuit breaker. | — |
| | | | | x | | | | | | | Overcrank shutdown | Reset the controller. If the overcrank fault occurs again, contact the distributor/dealer. | — |
| x | | | | | | | | | | | Transfer switch test switch in the OFF position | Move the transfer switch test switch to the AUTO position. | ATS O/M |
| | | | x | | | | | | | | Wiring, terminals, or pin in the exciter field open | Check for continuity. | Gen. S/M, W/D |
| | | | x | | | | | | | | Main field (rotor) inoperative (open or grounded) | Test and/or replace the rotor.† | Gen. S/M |
| | | | x | | | | | | | | Stator inoperative (open or grounded) | Test and/or replace the stator.† | Gen. S/M |
| | | | | | | | | | x | | Vibration excessive | Tighten loose components.† | — |
| **Lube System** | | | | | | | | | | | | | |
| | | | | | | x | x | | x | | Oil level low | Restore the oil level. Inspect the generator set for oil leaks. | Eng. O/M |
| | | | | x | | | | | | | Low oil pressure shutdown | Check the oil level. | Eng. O/M |
| | x | x | | | | | x | | x | | Crankcase oil type incorrect for ambient temperature | Change the oil. Use oil with a viscosity suitable for the operating climate. | Eng. O/M |

* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram

† Have an authorized service distributor/dealer perform this service.

**⚠ WARNING**

**Accidental starting.**
**Can cause severe injury or death.**

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

**Disabling the generator set. Accidental starting can cause severe injury or death.** Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

**⚠ WARNING**

**Hazardous voltage. Moving parts.**
**Can cause severe injury or death.**

Operate the generator set only when all guards and electrical enclosures are in place.

**Grounding electrical equipment. Hazardous voltage can cause severe injury or death.** Electrocution is possible whenever electricity is present. Ensure you comply with all applicable codes and standards. Electrically ground the generator set, transfer switch, and related equipment and electrical circuits. Turn off the main circuit breakers of all power sources before servicing the equipment. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

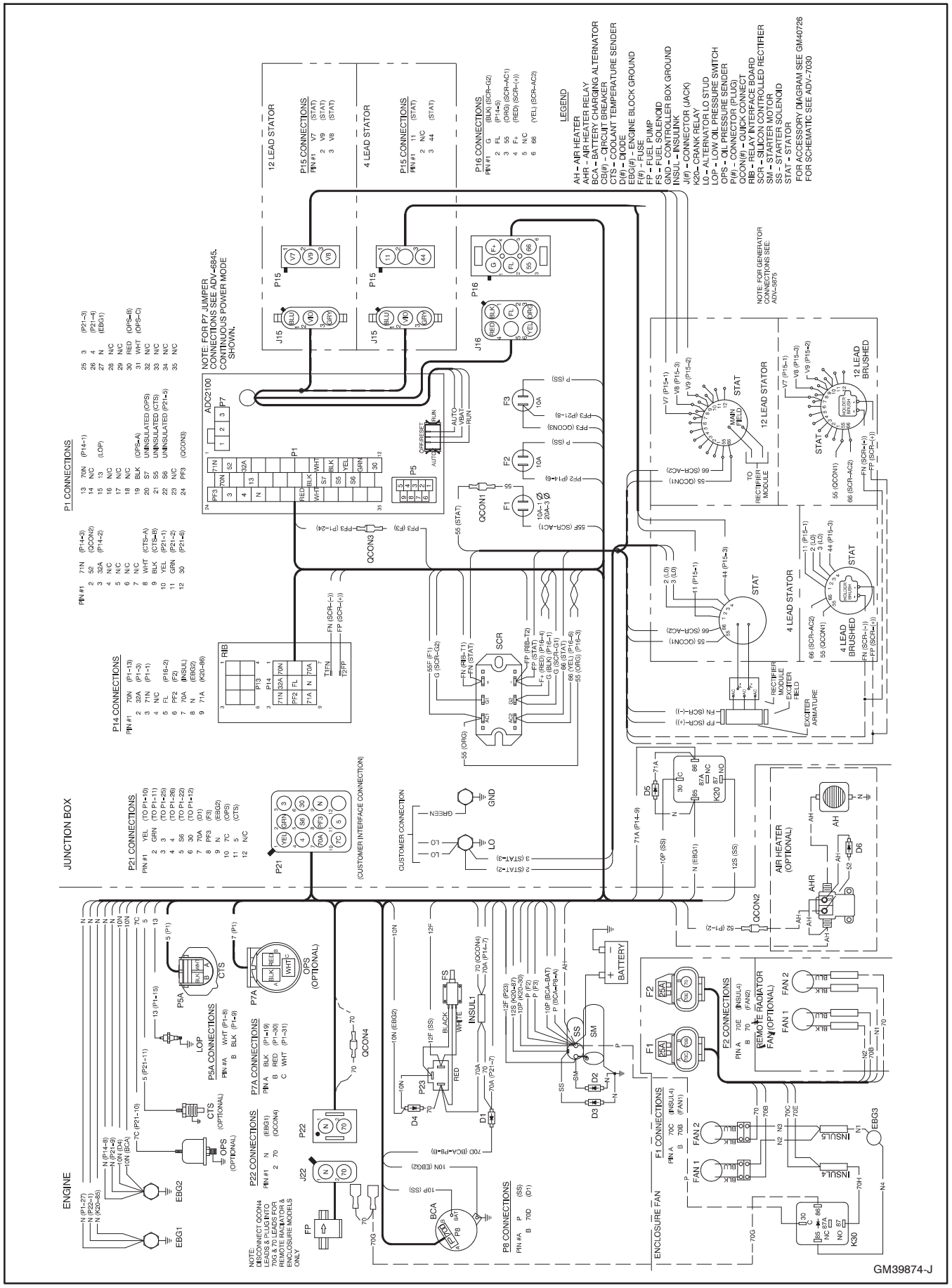



**Figure 5-1** Wiring Diagram (10–20EOR(Z)DB and 9–16.5EFOR(Z)DB)

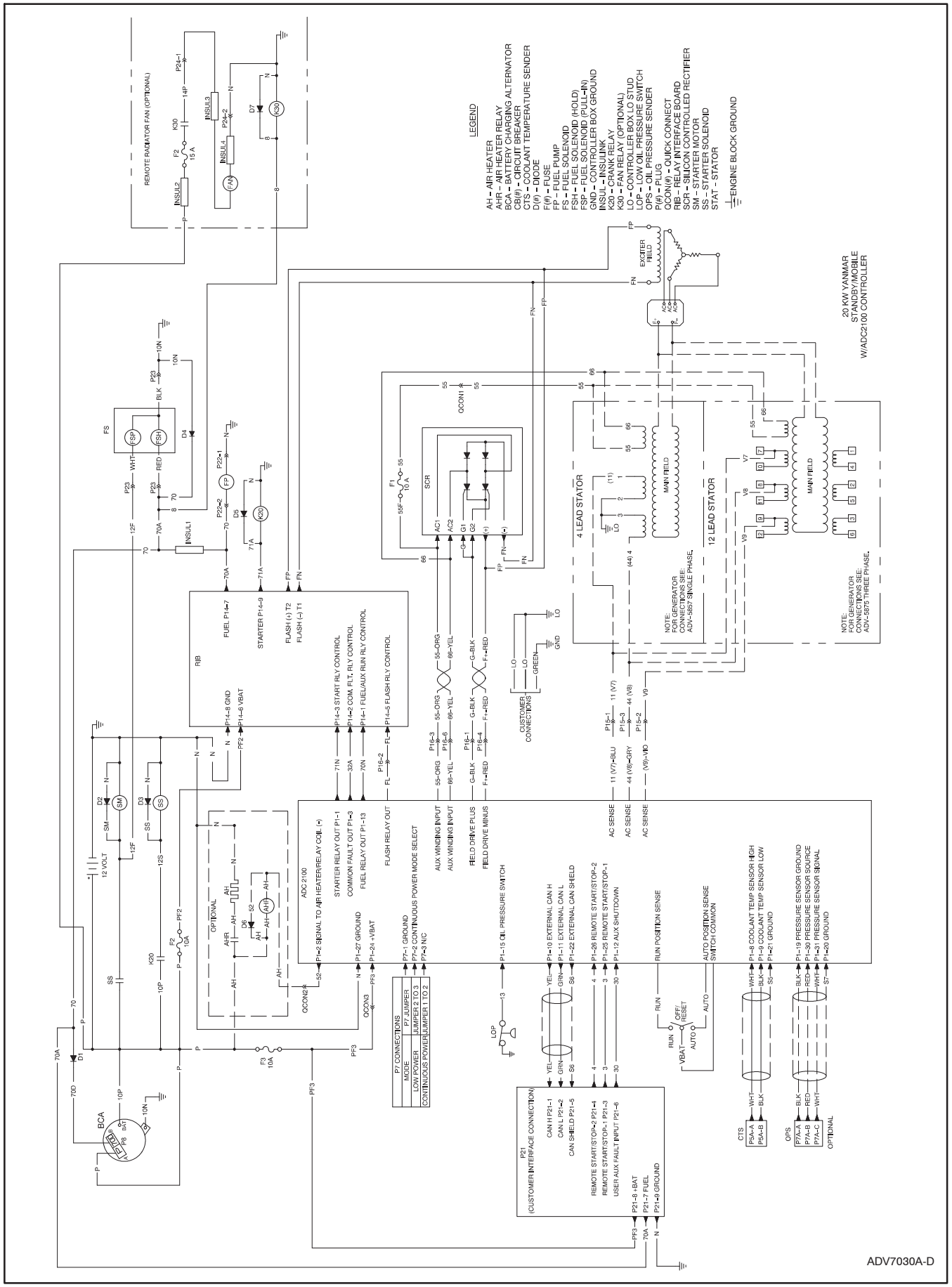



**Figure 5-2** Wiring Diagram, Schematic (10–20EOR(Z)DB and 9–16.5EFOR(Z)DB)

ADC 2100 CONTROLLER

RELAY INTERFACE BOARD

P1 CONNECTIONS
P1-1 STARTER RELAY OUT
P1-2 SIGNAL TO AIR HEATER/RELAY COIL (-)
P1-3 COMMON FAULT
P1-4 GOVERNOR 1B
P1-5 GOVERNOR 1A
P1-6 GOVERNOR 2A
P1-7 GOVERNOR 2B
P1-8 COOLANT TEMP SENSOR HIGH
P1-9 COOLANT TEMP SENSOR LOW
P1-10 EXTERNAL CAN H
P1-11 EXTERNAL CAN L
P1-12 AUX SHUTDOWN
P1-13 FUEL RELAY OUT
P1-14 TACH OUT
P1-15 OIL PRESSURE SWITCH
P1-16 GROUND
P1-17 VR SENSOR LOW
P1-18 GROUND
P1-19 PRESSURE SENSOR GROUND
P1-20 GROUND
P1-21 GROUND
P1-22 GROUND
P1-23 GROUND
P1-24 VBAT (+)
P1-25 REMOTE START/STOP 1
P1-26 REMOTE START/STOP 2
P1-27 GROUND
P1-28 COOLANT LEVEL/LOSS HIGH
P1-29 VR SENSOR HIGH
P1-30 PRESSURE SENSOR SOURCE
P1-31 PRESSURE SENSOR SIGNAL
P1-32 GROUND
P1-33 VBAT ON
P1-34 GROUND
P1-35 RS232 TXD

P5 CONNECTIONS
P5-1 N/C
P5-2 RS232 RXD
P5-3 RS232 TXD
P5-4 N/C
P5-5 GROUND
P5-6 N/C
P5-7 N/C
P5-8 N/C
P5-9 N/C

P7 CONNECTIONS
P7-1 N/C
P7-2 CONTINUOUS POWER MODE SELECT
P7-3 GROUND

J16 CONNECTIONS
P16-1 FIELD DRIVE PLUS (G)
P16-2 FLASH RELAY OUT
P16-3 AUX WINDING INPUT (55)
P16-4 FIELD DRIVE MINUS (F+)
P16-5 N/C
P16-6 AUX WINDING INPUT (66)

J15 CONNECTIONS
J15-1 AC INPUT (V7/11)
J15-2 AC INPUT (V9)
J15-3 AC INPUT (V8/44)

P13 CONNECTIONS
P13-1 RUN RELAY COMMON
P13-2 COMMON FAULT COMMON
P13-3 COMMON FAULT NC
P13-4 RUN RELAY NO
P13-5 RUN RELAY NC
P13-6 COMMON FAULT NO

P14 CONNECTIONS
P14-1 FUEL/AUX RUN RELAY CONTROL
P14-2 COMMON FAULT RELAY CONTROL
P14-3 STARTER RELAY CONTROL
P14-4 IGNITION NEGATIVE
P14-5 FLASH RELAY CONTROL
P14-6 VBAT
P14-7 FUEL (70A)
P14-8 GROUND
P14-9 STARTER (71A)

ADV7030B-D

**Figure 5-3** Wiring Diagram, Schematic (10–20EOR(Z)DB and 9–16.5EFOR(Z)DB)

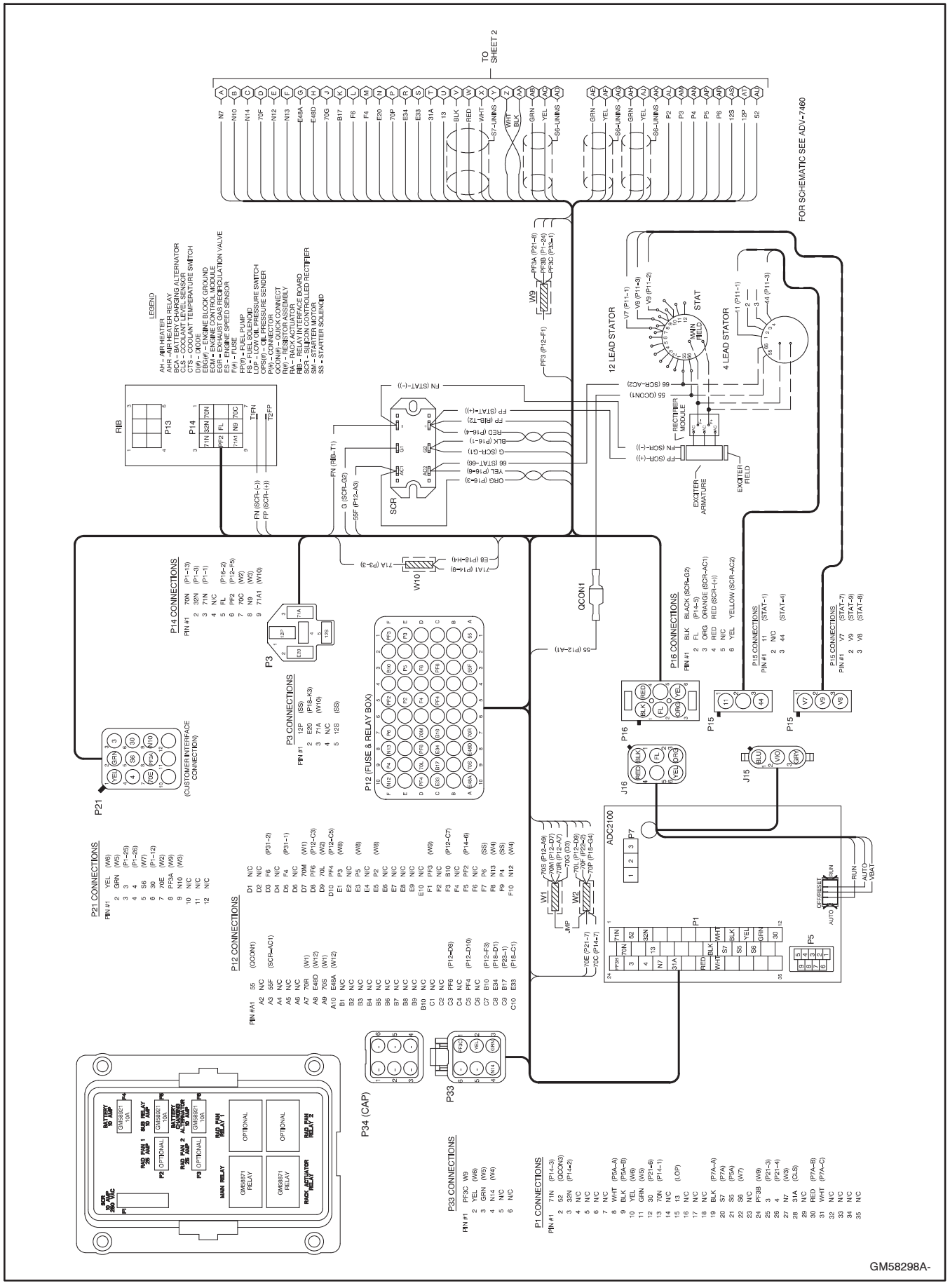



**Figure 5-4** Wiring Diagram (30/40EORZDB and 25/33EFORZDB)

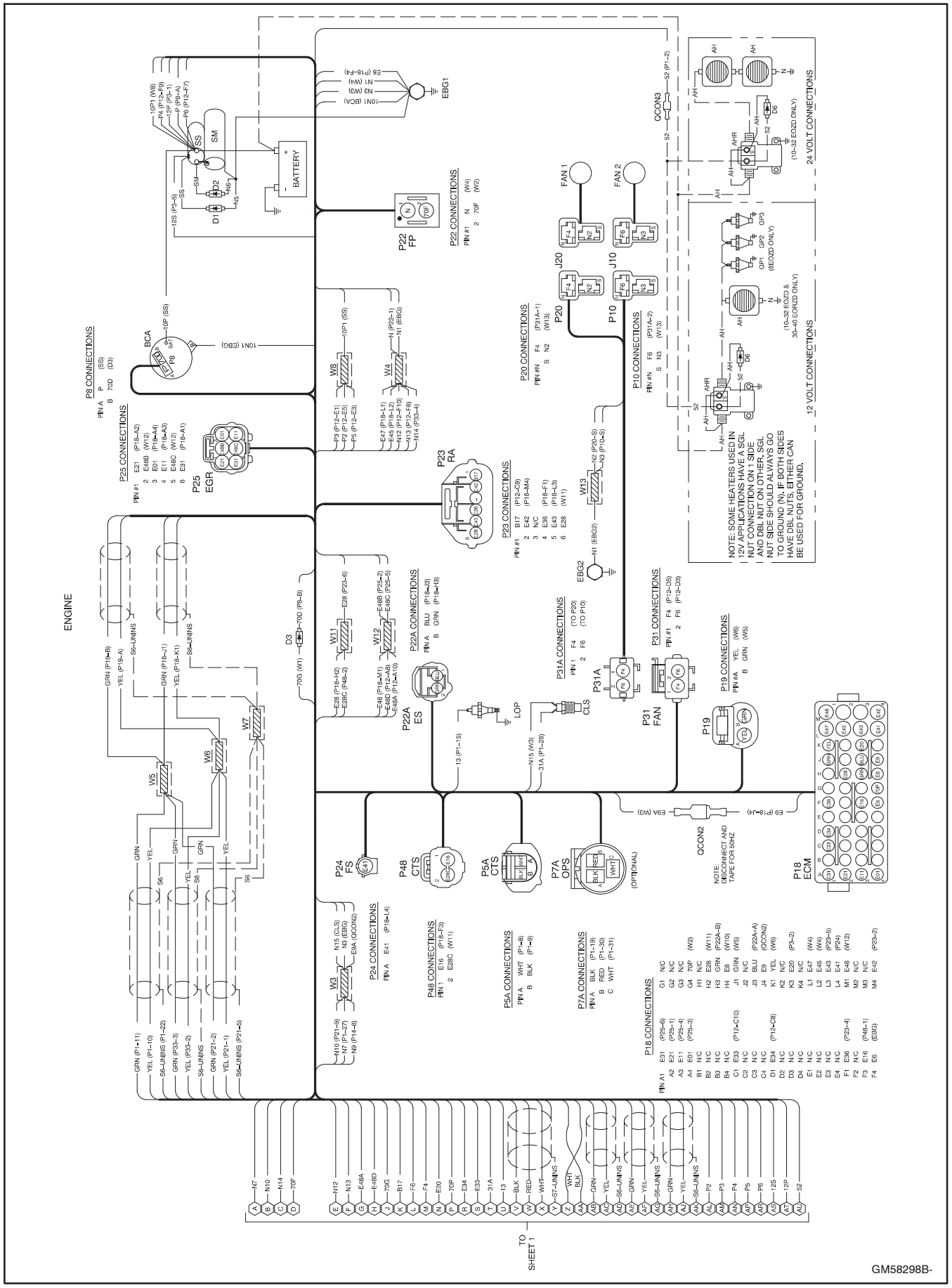



**Figure 5-5** Wiring Diagram (30/40EORZDB and 25/33EFORZDB)

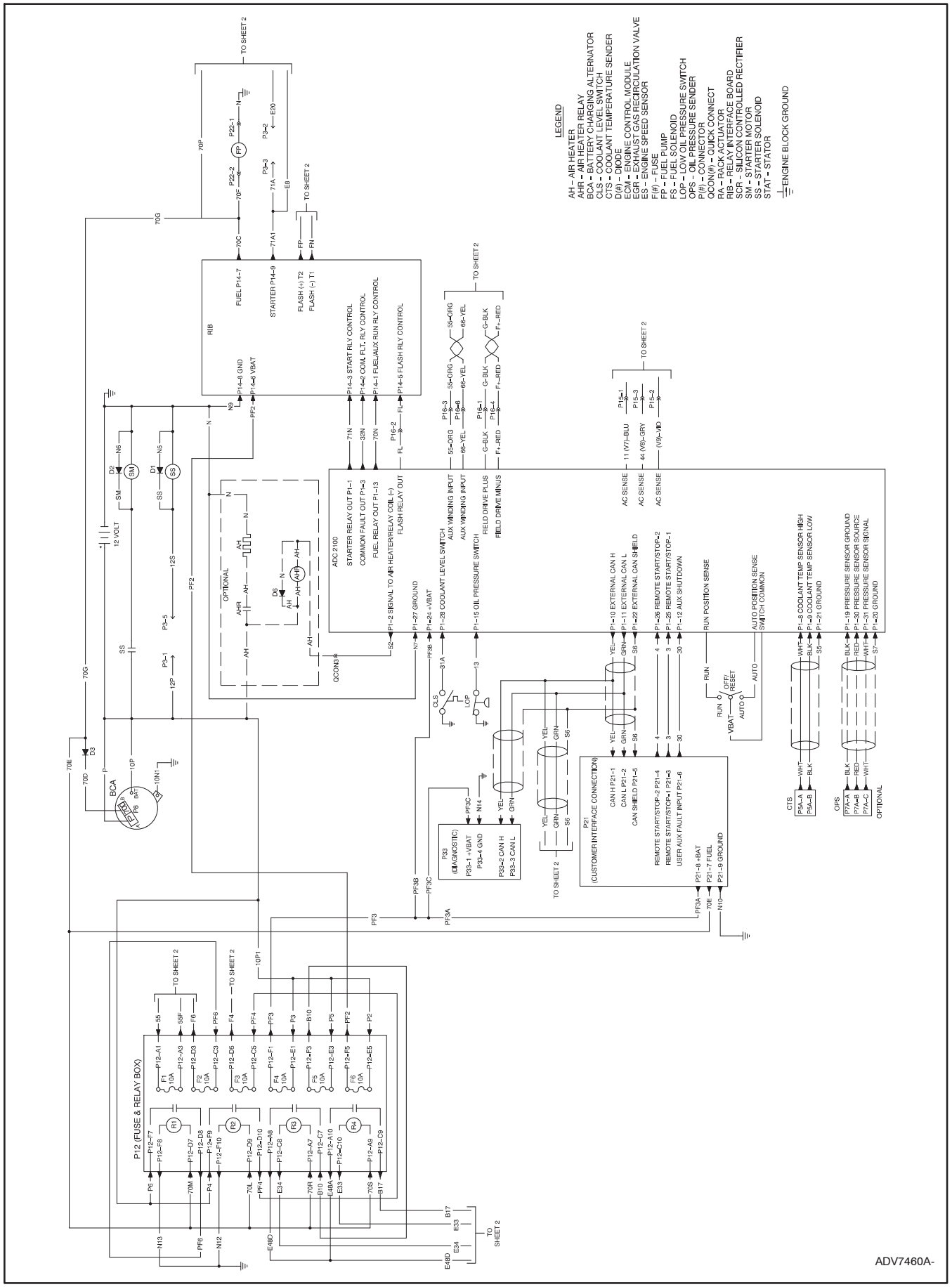

LEGEND
AH – AIR HEATER
AHR – AIR HEATER RELAY
BCA – BATTERY CHARGING ALTERNATOR
CLS – COOLANT LEVEL SWITCH
CTS – COOLANT TEMPERATURE SENDER
D(#) – DIODE
ECM – ENGINE CONTROL MODULE
EGR – EXHAUST GAS RECIRCULATION VALVE
ES – ENGINE SPEED SENSOR
F(#) – FUSE
FP – FUEL PUMP
FS – FUEL SOLENOID
LOP – LOW OIL PRESSURE SWITCH
OPS – OIL PRESSURE SENDER
P(#) – CONNECTOR
QCON(#) – QUICK CONNECT
RA – RACK ACTUATOR
RIB – RELAY INTERFACE BOARD
SCR – SILICON CONTROLLED RECTIFIER
SM – STARTER MOTOR
SS – STARTER SOLENOID
STAT – STATOR
ENGINE BLOCK GROUND
ADV7460A-

**Figure 5-6** Wiring Diagram, Schematic (30/40EORZDB and 25/33EFORZDB)

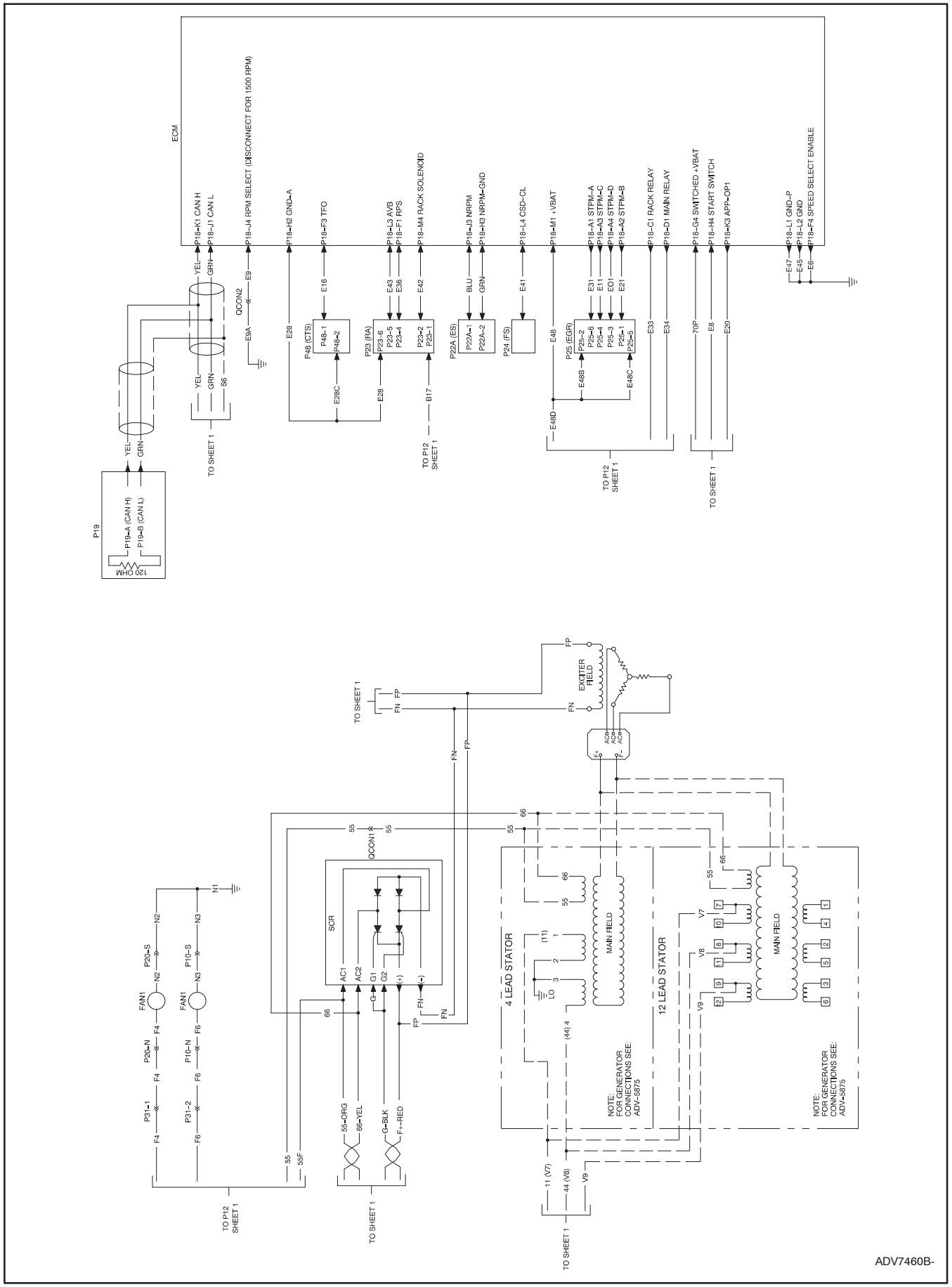



**Figure 5-7** Wiring Diagram, Schematic (30/40EORZDB and 25/33EFORZDB)

# Appendix A Abbreviations

The following list contains abbreviations that may appear in this publication.

| | |
|---|---|
| A, amp | ampere |
| ABDC | after bottom dead center |
| AC | alternating current |
| A/D | analog to digital |
| ADC | analog to digital converter |
| adj. | adjust, adjustment |
| ADV | advertising dimensional drawing |
| AHWT | anticipatory high water temperature |
| AISI | American Iron and Steel Institute |
| ALOP | anticipatory low oil pressure |
| alt. | alternator |
| Al | aluminum |
| ANSI | American National Standards Institute (formerly American Standards Association, ASA) |
| AO | anticipatory only |
| API | American Petroleum Institute |
| approx. | approximate, approximately |
| AR | as required, as requested |
| AS | as supplied, as stated, as suggested |
| ASE | American Society of Engineers |
| ASME | American Society of Mechanical Engineers |
| assy. | assembly |
| ASTM | American Society for Testing Materials |
| ATDC | after top dead center |
| ATS | automatic transfer switch |
| auto. | automatic |
| aux. | auxiliary |
| A/V | audiovisual |
| avg. | average |
| AVR | automatic voltage regulator |
| AWG | American Wire Gauge |
| AWM | appliance wiring material |
| bat. | battery |
| BBDC | before bottom dead center |
| BC | battery charger, battery charging |
| BCA | battery charging alternator |
| BCI | Battery Council International |
| BDC | before dead center |
| BHP | brake horsepower |
| blk. | black (paint color), block (engine) |
| blk. htr. | block heater |
| BMEP | brake mean effective pressure |
| bps | bits per second |
| br. | brass |
| BTDC | before top dead center |
| Btu | British thermal unit |
| Btu/min. | British thermal units per minute |
| C | Celsius, centigrade |
| cal. | calorie |
| CARB | California Air Resources Board |
| CB | circuit breaker |
| cc | cubic centimeter |
| CCA | cold cranking amps |
| ccw. | counterclockwise |
| CEC | Canadian Electrical Code |
| cfh | cubic feet per hour |
| cfm | cubic feet per minute |
| CG | center of gravity |
| CID | cubic inch displacement |
| CL | centerline |
| cm | centimeter |
| CMOS | complementary metal oxide substrate (semiconductor) |
| cogen. | cogeneration |
| Com | communications (port) |
| conn. | connection |
| cont. | continued |
| CPVC | chlorinated polyvinyl chloride |
| crit. | critical |
| CRT | cathode ray tube |
| CSA | Canadian Standards Association |
| CT | current transformer |
| Cu | copper |
| cu. in. | cubic inch |
| cw. | clockwise |
| CWC | city water-cooled |
| cyl. | cylinder |
| D/A | digital to analog |
| DAC | digital to analog converter |
| dB | decibel |
| dBA | decibel (A weighted) |
| DC | direct current |
| DCR | direct current resistance |
| deg., ° | degree |
| dept. | department |
| dia. | diameter |
| DI/EO | dual inlet/end outlet |
| DIN | Deutsches Institut fur Normung e. V. (also Deutsche Industrie Normenausschuss) |
| DIP | dual inline package |
| DPDT | double-pole, double-throw |
| DPST | double-pole, single-throw |
| DS | disconnect switch |
| DVR | digital voltage regulator |
| E, emer. | emergency (power source) |
| EDI | electronic data interchange |
| EFR | emergency frequency relay |
| e.g. | for example (*exempli gratia)* |
| EG | electronic governor |
| EGSA | Electrical Generating Systems Association |
| EIA | Electronic Industries Association |
| EI/EO | end inlet/end outlet |
| EMI | electromagnetic interference |
| emiss. | emission |
| eng. | engine |
| EPA | Environmental Protection Agency |
| EPS | emergency power system |
| ER | emergency relay |
| ES | engineering special, engineered special |
| ESD | electrostatic discharge |
| est. | estimated |
| E-Stop | emergency stop |
| etc. | et cetera (and so forth) |
| exh. | exhaust |
| ext. | external |
| F | Fahrenheit, female |
| fglass. | fiberglass |
| FHM | flat head machine (screw) |
| fl. oz. | fluid ounce |
| flex. | flexible |
| freq. | frequency |
| FS | full scale |
| ft. | foot, feet |
| ft. lbs. | foot pounds (torque) |
| ft./min. | feet per minute |
| g | gram |
| ga. | gauge (meters, wire size) |
| gal. | gallon |
| gen. | generator |
| genset | generator set |
| GFI | ground fault interrupter |
| GND, ⏚ | ground |
| gov. | governor |
| gph | gallons per hour |
| gpm | gallons per minute |
| gr. | grade, gross |
| GRD | equipment ground |
| gr. wt. | gross weight |
| H x W x D | height by width by depth |
| HC | hex cap |
| HCHT | high cylinder head temperature |
| HD | heavy duty |
| HET | high exhaust temperature |
| hex | hexagon |
| Hg | mercury (element) |
| HH | hex head |
| HHC | hex head cap |
| HP | horsepower |
| hr. | hour |
| HS | heat shrink |
| hsg. | housing |
| HVAC | heating, ventilation, and air conditioning |
| HWT | high water temperature |
| Hz | hertz (cycles per second) |
| IC | integrated circuit |
| ID | inside diameter, identification |
| IEC | International Electrotechnical Commission |
| IEEE | Institute of Electrical and Electronics Engineers |
| IMS | improved motor starting |
| in. | inch |
| in. $H_2O$ | inches of water |
| in. Hg | inches of mercury |
| in. lbs. | inch pounds |
| Inc. | incorporated |
| ind. | industrial |
| int. | internal |
| int./ext. | internal/external |
| I/O | input/output |
| IP | iron pipe |
| ISO | International Organization for Standardization |
| J | joule |
| JIS | Japanese Industry Standard |
| k | kilo (1000) |
| K | kelvin |
| kA | kiloampere |
| KB | kilobyte ($2^{10}$ bytes) |

| | |
|---|---|
| kg | kilogram |
| kg/cm$^2$ | kilograms per square centimeter |
| kgm | kilogram-meter |
| kg/m$^3$ | kilograms per cubic meter |
| kHz | kilohertz |
| kJ | kilojoule |
| km | kilometer |
| kOhm, kΩ | kilo-ohm |
| kPa | kilopascal |
| kph | kilometers per hour |
| kV | kilovolt |
| kVA | kilovolt ampere |
| kVAR | kilovolt ampere reactive |
| kW | kilowatt |
| kWh | kilowatt-hour |
| kWm | kilowatt mechanical |
| L | liter |
| LAN | local area network |
| L x W x H | length by width by height |
| lb. | pound, pounds |
| lbm/ft$^3$ | pounds mass per cubic feet |
| LCB | line circuit breaker |
| LCD | liquid crystal display |
| ld. shd. | load shed |
| LED | light emitting diode |
| Lph | liters per hour |
| Lpm | liters per minute |
| LOP | low oil pressure |
| LP | liquefied petroleum |
| LPG | liquefied petroleum gas |
| LS | left side |
| $L_{wa}$ | sound power level, A weighted |
| LWL | low water level |
| LWT | low water temperature |
| m | meter, milli (1/1000) |
| M | mega (10$^6$ when used with SI units), male |
| m$^3$ | cubic meter |
| m$^3$/min. | cubic meters per minute |
| mA | milliampere |
| man. | manual |
| max. | maximum |
| MB | megabyte (2$^{20}$ bytes) |
| MCM | one thousand circular mils |
| MCCB | molded-case circuit breaker |
| meggar | megohmmeter |
| MHz | megahertz |
| mi. | mile |
| mil | one one-thousandth of an inch |
| min. | minimum, minute |
| misc. | miscellaneous |
| MJ | megajoule |
| mJ | millijoule |
| mm | millimeter |
| mOhm, mΩ | milliohm |
| MOhm, MΩ | megohm |
| MOV | metal oxide varistor |
| MPa | megapascal |
| mpg | miles per gallon |
| mph | miles per hour |
| MS | military standard |
| m/sec. | meters per second |
| MTBF | mean time between failure |
| MTBO | mean time between overhauls |
| mtg. | mounting |
| MW | megawatt |
| mW | milliwatt |
| μF | microfarad |
| N, norm. | normal (power source) |
| NA | not available, not applicable |
| nat. gas | natural gas |
| NBS | National Bureau of Standards |
| NC | normally closed |
| NEC | National Electrical Code |
| NEMA | National Electrical Manufacturers Association |
| NFPA | National Fire Protection Association |
| Nm | newton meter |
| NO | normally open |
| no., nos. | number, numbers |
| NPS | National Pipe, Straight |
| NPSC | National Pipe, Straight-coupling |
| NPT | National Standard taper pipe thread per general use |
| NPTF | National Pipe, Taper-Fine |
| NR | not required, normal relay |
| ns | nanosecond |
| OC | overcrank |
| OD | outside diameter |
| OEM | original equipment manufacturer |
| OF | overfrequency |
| opt. | option, optional |
| OS | oversize, overspeed |
| OSHA | Occupational Safety and Health Administration |
| OV | overvoltage |
| oz. | ounce |
| p., pp. | page, pages |
| PC | personal computer |
| PCB | printed circuit board |
| pF | picofarad |
| PF | power factor |
| ph., ∅ | phase |
| PHC | Phillips head crimptite (screw) |
| PHH | Phillips hex head (screw) |
| PHM | pan head machine (screw) |
| PLC | programmable logic control |
| PMG | permanent-magnet generator |
| pot | potentiometer, potential |
| ppm | parts per million |
| PROM | programmable read-only memory |
| psi | pounds per square inch |
| pt. | pint |
| PTC | positive temperature coefficient |
| PTO | power takeoff |
| PVC | polyvinyl chloride |
| qt. | quart |
| qty. | quantity |
| R | replacement (emergency) power source |
| rad. | radiator, radius |
| RAM | random access memory |
| RDO | relay driver output |
| ref. | reference |
| rem. | remote |
| RFI | radio frequency interference |
| RH | round head |
| RHM | round head machine (screw) |
| rly. | relay |
| rms | root mean square |
| rnd. | round |
| ROM | read only memory |
| rot. | rotate, rotating |
| rpm | revolutions per minute |
| RS | right side |
| RTV | room temperature vulcanization |
| SAE | Society of Automotive Engineers |
| scfm | standard cubic feet per minute |
| SCR | silicon controlled rectifier |
| s, sec. | second |
| SI | *Systeme international d'unites,* International System of Units |
| SI/EO | side in/end out |
| sil. | silencer |
| SN | serial number |
| SPDT | single-pole, double-throw |
| SPST | single-pole, single-throw |
| spec, specs | specification(s) |
| sq. | square |
| sq. cm | square centimeter |
| sq. in. | square inch |
| SS | stainless steel |
| std. | standard |
| stl. | steel |
| tach. | tachometer |
| TD | time delay |
| TDC | top dead center |
| TDEC | time delay engine cooldown |
| TDEN | time delay emergency to normal |
| TDES | time delay engine start |
| TDNE | time delay normal to emergency |
| TDOE | time delay off to emergency |
| TDON | time delay off to normal |
| temp. | temperature |
| term. | terminal |
| TIF | telephone influence factor |
| TIR | total indicator reading |
| tol. | tolerance |
| turbo. | turbocharger |
| typ. | typical (same in multiple locations) |
| UF | underfrequency |
| UHF | ultrahigh frequency |
| UL | Underwriter's Laboratories, Inc. |
| UNC | unified coarse thread (was NC) |
| UNF | unified fine thread (was NF) |
| univ. | universal |
| US | undersize, underspeed |
| UV | ultraviolet, undervoltage |
| V | volt |
| VAC | volts alternating current |
| VAR | voltampere reactive |
| VDC | volts direct current |
| VFD | vacuum fluorescent display |
| VGA | video graphics adapter |
| VHF | very high frequency |
| W | watt |
| WCR | withstand and closing rating |
| w/ | with |
| w/o | without |
| wt. | weight |
| xfmr | transformer |

# Appendix B Operating Hour Service Log

Use the log below to keep a cumulative record of operating hours on your generator set and the dates required services were performed. Enter hours to the nearest quarter hour.

| | OPERATING HOURS | | SERVICE RECORD | |
|---|---|---|---|---|
| DATE RUN | HOURS RUN | TOTAL HOURS | SERVICE DATE | SERVICE |
| | | | | |
| | | | | |
| | | | |

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